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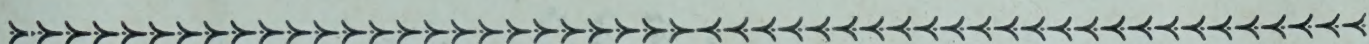


HYGEIA

Goddess of health of the ancient Greeks.
(Courtesy of Hygeia, the Health Magazine.)

THE FUNDAMENTALS OF
PERSONAL HYGIENE

Their Practical Application to Healthful Living



By

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FIFTH EDITION

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Preface to the Fifth Edition



THE book has undergone thorough revision to bring it in line with the latest advances and points of view in the field of healthful living. The rapid recent progress on all scientific fronts has made possible the inclusion of much new material. Nearly every chapter has been greatly altered with the addition of new, and deletion of outdated subject matter. In order thoroughly to incorporate new material with the old, much of the old material, although still relevant, has been rewritten to achieve a clear, orderly arrangement and in some instances to permit a new approach.

In this edition, as in the previous ones, the basic facts of personal hygiene have been presented with the definite aim of assisting the student to formulate a rational health program for daily living and thus to acquire the art of living healthfully. Since the facts of hygiene have value only to the extent to which they are applied, the writer has attempted to motivate the student to make the necessary effort to attain a high level of health. The individual who desires to realize his potentialities to the fullest must acquire a wholesome attitude toward the basic principles of healthful living, appreciate the tremendous significance of the health knowledge science has unearthed and make use of this knowledge in his daily living. He should not be satisfied with "average" health when optimum health is attainable. A person in optimum health is in a position to live happily and productively, and to appreciate the sacredness of individual liberty in a free society.

The introductory chapter has much new material, including mention of the present world situation in relation to its bearing on mental health, and a brief presentation of the work of the World Health Organization. The main objective of this chapter is to provide a suitable approach to the subject so that the student may become properly oriented in the field of hygiene and develop a salutary attitude toward the principles of healthful living.

Since many persons lack a correct understanding of their food re-

quirements and go through life inadequately fed, a relatively large portion of the book is devoted to the subject of nutrition. The writer has attempted to make this presentation as practical as possible so that the student will have the understanding necessary to select a dietary that will provide a properly balanced intake of essential food constituents. Tables based on recent data giving the vitamin and caloric values of average servings of foods commonly used have been included. The dietary recommendations in regard to the vitamin, mineral, protein and caloric requirements are those of the Food and Nutrition Board of the National Research Council. Discussions of food poisoning, food allergy and nutritional anemia have been included. The material dealing with the digestive system, which was originally part of a chapter, has been expanded and now forms a separate chapter. The newer tables of body weights, which take into account the type of body build, are included in the discussion of the relation of body weight to health.

The recent developments in the control of dental caries, including the topical application of sodium fluoride to the teeth and the advent of ammoniated dentifrices, have been included in the discussion of the hygiene of the mouth. In the chapter on the skin the section on cosmetics has been brought up to date.

Much of the subject matter in the chapter devoted to the health of the mind has been rearranged and rewritten, and the discussion of mental maladjustment has been enlarged. The chapter dealing with the hygiene of sex is almost entirely new. It has been prepared from the point of view of assisting young people to acquire satisfactory attitudes and to reach sound conclusions concerning matters of sex. Suitable standards of conduct are suggested and a discussion of the factors that affect marital happiness has been included.

Since mystery and magic still have a strong hold on the human mind, a brief discussion of human gullibility has been included in the chapter entitled "Health Fads, Fancies and Follies." The discussion on alcohol has been enlarged chiefly by the addition of material on the rehabilitation of the alcoholic individual.

The material constituting the last chapter of the previous edition, which was entitled "Disease Prevention," has been greatly expanded and divided into four chapters. This has been done to give the individual a sufficiently complete understanding of disease and methods of immunization to enable him to take advantage of specific, available measures to safeguard himself against preventable illness. Since disease is still an important aspect of human life, it seemed advisable to make this change.

The first of these new chapters (Chapter 18) deals with the process of infection. It provides information on the causative agents of infection, sources and modes of transfer of infection and the course of infectious disease.

Chapter 19 treats of the strategy of the various defense mechanisms of the body, the role of health in the resistance to infection, types of immunity and methods of conferring immunity. Other control measures such as the proper disposal of sewage, provision of a sanitary water supply, the sanitary handling of food, the proper washing of dishes in eating establishments and the importance of personal cleanliness are given consideration.

In Chapter 20, which is devoted to infectious diseases, essential facts about certain diseases are presented, including factors that increase the individual's vulnerability to these diseases. It is hoped that this information will be of value to the individual in taking measures to protect himself against these infections. The diseases discussed include the common cold, influenza, tuberculosis, pneumonia, brucellosis, tetanus, typhoid fever, diphtheria and smallpox.

The final chapter discusses maladies that are not communicable, including the so-called "degenerative diseases." It embraces disorders of the heart and blood vessels, cancer, nephritis, arthritis, diabetes mellitus and allergic conditions.

The bibliographies appended to the individual chapters have been revised to incorporate many recent books. Some of the illustrations have been discarded and a number of new ones have been introduced.

Although the book is addressed primarily to students at the college level, it should be of value to other readers who may be interested in the promotion of personal health. It is the hope of the writer that the information conveyed in these pages will assist the student in adequately adjusting himself to his environment and emancipating himself from misconceptions so that he may attain a high level of physical and mental well-being.

WALTER W. KRUEGER

Grand Rapids, Michigan

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CHAPTER 1

Introduction

MAN is a part of nature, subject to natural laws like all other living things. The principles of cause and effect run through human life exactly as they do through the objective world. It is necessary for man to understand and live within the fundamental rules that govern his life. Nature does not permit him to revise her mandates.

Each individual's health is in a large measure his own responsibility. It is essential to recognize and accept this responsibility. Life does not owe us health any more than it owes us success. Health is not an inalienable right nor does it come to us as a matter of chance. It is a goal to be achieved. Life can be of great significance if the necessary effort is put forth to attain a high level of physical and mental well-being. Wise attention and conformance to nature's code of health offers great rewards, whereas neglect of her requirements takes its toll not only in wrecked bodies but also in diseased minds.

Every person is naturally interested in maintaining himself in a state of health, but many fail to do so. Physical examinations reveal that there is a considerable prevalence of health impairment among our people. Many persons lack a correct understanding of their food requirements and go through life inadequately fed. Many never acquire the habits needed to attain a high level of health. Being uninformed keeps them from benefiting from the newer knowledge of healthful living.

LIVING IN THE MODERN WORLD

Our lives are influenced to a considerable degree by the struggles and tensions of the times. We must take cognizance of the fact that all nations and all peoples of the world have been thrown closer together than ever before by improved intercommunication and rapid modes of transportation, and by events of the recent war. The conditions that exist in one nation are bound to affect the other nations. The world is passing through a crisis—political, social and economic. It is divided chiefly into two camps, one bloc of nations enmeshed in a rigid ideological communism under the domination of an all-powerful bureaucracy, the other group

made up of democratic nations, each one independent, each one a flexible democracy.

As the world is now constituted we cannot remove ourselves from the common dangers and problems of all mankind. Because of the present situation, disillusionment has swept across the democratic world in the bitter realization that man has failed in the building of a satisfactory social order. We are facing an unknown and unpredictable future. This situation is not the most favorable for mental health, yet we must maintain our health since health is essential for the protection and preservation of our way of life.

It is inadvisable to assume an attitude of despair. Obstacles are ahead of us, to be sure, but with resourcefulness we may overcome them and help rebuild the world on a more enduring basis. The future will be different from the past. There is no definitely fixed and final way of life. Because America is the bulwark of democracy, it is urgent that our people be kept physically fit so that they may cope with any situation that may arise.

FACTORS THAT INFLUENCE HEALTH

The health of the individual depends partly on his inheritance but chiefly on an understanding of those factors that influence health and the proper use of this knowledge. The individual who covets a full, rich and wholesome life must include in his program of living an adequate amount of wholesome food; physical activity and outdoor play adapted to his individual capacity, interests and needs; good body carriage; proper care of the feet; preventive and therapeutic dental and medical services whenever needed; ample sleep each night under healthful conditions; a suitable occupation; proper use of leisure time and a wholesome mental attitude toward life. A suitable health program includes all of these factors; it does not emphasize one to the exclusion of others. Because of the many factors to which a person must adjust himself in modern life, he needs guidance in making satisfactory adjustments.

There is no magic prescription, no secret formula that can promise health. Good health is out of reach if one turns a deaf ear to the cardinal requirements of nature.

ADJUSTMENT TO ENVIRONMENT

In order to exist living organisms must adjust themselves to the particular locations in which they dwell, i.e., to their environment. The process of living involves constant adjustment and readjustment to environmental factors. Man, as well as other living beings, is inescapably

dependent upon and thoroughly interwoven with his environment. The environment of modern man is partly natural and partly man-made, and consists of physical, biologic and social factors. It is the source of his food, fuel, shelter, clothing and all the things he uses. Among the physical factors are climate, air, light, sunshine, temperature, food, water, buildings and their contents, and the numerous mechanical devices modern man has learned to produce. The biologic factors consist of the animals



Fig. 1. The Spirit of Life. (Courtesy of Delaware and Hudson Company.)

and plants, including disease-producing microorganisms, in his surroundings. The social factors include the customs, beliefs, ideas, peculiarities and ways of living of the human beings with whom he comes in contact.

Because man is a social organism, his adaptation to the complex social and economic order characteristic of modern civilization is as necessary as adaptation to his nonsocial surroundings. Since few environmental factors are static, life is a continuous process of adjustment and readjustment to an ever changing environment. The complexity of the environment of modern man places a strain on his powers of adjustment and calls for intelligence and effort to make proper adaptations. The present unsettled condition of the world adds to these problems.

Education in general increases the individual's capacity to live his life understandingly, i.e., to make proper adjustments to his total environment; health education enables him to make the necessary adjustments to attain the highest level of health for which he is biologically capable.

To attain buoyant health the individual must learn to cope successfully with his physical, biologic and social environment. If he is successful in this achievement, he has acquired the art of living healthfully. Adjustment is the price of life, adequate adjustment the price of health.

MEANING OF HEALTH AND HYGIENE

Health may be defined as that state in which the mental and physical activities of the body are adjusted satisfactorily to the environment. To be in health means much more than freedom from disease and discomfort. It includes the normal functioning of all parts of the human organism, resulting in physical strength and vigor, mental stability and satisfaction with life.

In the preamble to the constitution of the World Health Organization, health is defined as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." The concept of health thus has positive and constructive implications. Health implies a sufficient reserve of physical strength, agility and endurance, as well as mental poise, to meet the demands of everyday life.

The healthy individual is characterized by (1) a sense of well-being, (2) ability to work efficiently and with enthusiasm, (3) cheerfulness, (4) self-confidence, (5) self-control, (6) absence of disease and freedom from physical discomfort, (7) a wholesome mental attitude, (8) freedom from unnecessary anxiety, (9) courage to face reality, and (10) wholesome fatigue at the end of the day with restful undisturbed sleep at night.

There are various levels or degrees of health. Health, like success or wealth, is always relative and must be thought of in terms of the age of the individual. Perfect health, being an abstraction, is not an attainable condition. Optimum health is the highest level of health attainable by the individual. The attainment of optimum health is the objective for which each individual should strive.

Hygiene may be defined as the science and art of preserving and improving health. It is a science in that it is based upon scientific knowledge, and an art in that it involves the development of skill in the systematic application of this knowledge to the daily routine of life. It includes all agencies that have a bearing on the physical and mental health of man. The aim of hygiene is not merely to impart knowledge but to teach the

individual to take the necessary action to improve the quality of his life in its physical as well as mental aspects, so that he may have buoyant health throughout life.

Hygiene deals both with the individual and the community. The branch of hygiene that concerns itself with the adjustments the individual must make to preserve and improve the health of his body and mind is known as *personal hygiene*.

The art and science of maintaining, protecting and improving the health of the people through organized community efforts is known as *public health*. It is concerned with the control of communicable diseases for the protection of the community, and with furnishing medical service for special groups of persons.

The term *sanitation*, as generally used, refers to the branch of public health that is concerned with keeping the external environment healthful. The sanitarian directs his efforts toward the maintenance of a safe drinking water free from pollution and harmful organisms, control over the disposal of sewage, inspection of the sanitary condition of the food supply, the enforcement of housing regulations and the control of rats, flies, mosquitoes and other intermediate sources of disease transmission. Sanitation is an important branch of public health work.

Social hygiene deals with problems of sex from the public health standpoint.

MODERN SCIENCE AND HEALTH

Life in the past was much more hazardous than it is at present. Sickness and premature death have shadowed man through the ages. Many diseases which in the past occurred in terrifying and gruesome epidemics have been reduced to a point where they no longer play the role of formidable enemies. The progress that has been made permits us to be optimistic about the future since we may expect further impressive gains. For a period of four centuries the Black Death (bubonic plague) devastated every part of Europe, killing in some cities two-thirds of their inhabitants. In the thirteenth century it almost depopulated northern Europe. The plague came under control with a concerted program of rat eradication. Rats serve as hosts to plague-infested fleas.

Smallpox, one of the great killers of the past, became a preventable disease with the discovery of vaccination by Edward Jenner in 1796. Repeated epidemics of yellow fever occurred in parts of the United States, especially in towns on the Atlantic seaboard and in the lower Mississippi valley. New York and Philadelphia suffered severely. The discovery that

the germs of the disease are spread by mosquitoes made it possible to stamp out yellow fever completely in the United States.

Typhoid fever, once rampant, is now a disease of minor prevalence. It can be effectively stamped out by environmental sanitation, particularly through the safeguarding of public water and milk supplies. Immunization by vaccination is also available. Typhoid fever still occurs sporadically, chiefly because of many unknown carriers of the causative organisms. The subjugation of typhoid fever has been a major triumph of sanitary science.

In the past, disastrous epidemics of diphtheria spread through the nation, causing untold suffering and agonizing death. Phenomenal progress has been made toward its eradication. It can now be prevented by immunizing children with diphtheria toxoid. Although preventive inoculation is available and effective, diphtheria still kills many children each year in the United States due to the fact that many mothers fail to have their children immunized.

Although tuberculosis is still a major public health problem, it has lost much of its terror. In 1910 its mortality rate was 160 per 100,000 population, whereas at present it is less than 35 per 100,000 population. It still, however, ranks as a leading cause of death among persons fifteen to forty-five years of age, man's most productive period. The decline of tuberculosis has resulted from a combination of factors including early diagnosis, prompt isolation, sanitarium treatment, artificial pneumothorax and other surgical procedures, use of streptomycin in selected cases and the general rise in the standard of living.

A large reduction has occurred in the infant death rate. In 1915 one hundred out of every thousand babies died before they attained the age of one year. At present the death rate is below 32 per 1000 live births. This saving of the lives of infants has been accomplished chiefly by providing safe water and milk supplies and by better ways of feeding and caring for them.

Less dramatic progress has been made in the control of other diseases, particularly those that are chronic in nature. Many chronic diseases such as hyperthyroidism, amebiasis, beriberi, pellagra and scurvy are curable. Others, however, although not curable are now largely controllable. Among these are diabetes mellitus and pernicious anemia.

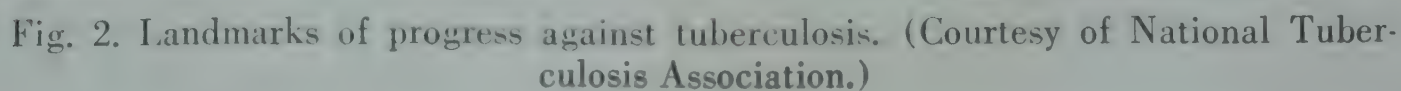
Remarkable progress has been made in the field of therapeutics. Included in the developments in this field are vaccines for the prevention, and antisera for the treatment, of disease, insulin for diabetes, liver extract for pernicious anemia and vitamins for vitamin deficiency diseases. An out-

standing development was the discovery of the sulfonamide drugs, including sulfanilamide, sulfapyridine, sulfathiazole, sulfadiazine and sulfaguanidine, which have revolutionized treatment of a number of diseases. The use of x-rays, radium and radioactive isotopes is saving or prolonging many lives. The most recent advance was the discovery of antibiotics. Penicillin, the first one obtained, has exceeded the sulfonamides in its accomplishments. Streptomycin, another antibiotic, shows promise of being of value in the treatment of tuberculosis.

Human blood and certain derivatives obtained by the process known as blood fractionation are now used as therapeutic agents. Whole blood is employed in the treatment of hemorrhage; red corpuscles are used in anemia; plasma in shock and abnormal decrease of proteins in the blood (hypoproteinemia); fraction I in cases of hemophilia (delayed clotting) and in surgery; and gamma globulin in the modification or the prevention of measles. In the present mechanical age in which accidents constitute a major cause of death the therapeutic use of blood and certain of its fractions is of particular importance in the saving of human lives. The various therapeutic agents now available play decisive roles in the conservation of human life, and foreshadow further forward strides in the war against disease.

The accomplishments of preventive and therapeutic medicine so far attained have had a decided effect in reducing the death rate and increasing the average duration of life. There has been a spectacular reduction in infantile and juvenile death rates. Only a few decades ago the principal diseases of childhood, measles, diphtheria, scarlet fever and whooping cough, exacted a heavy toll of child life. Today these diseases play only a minor role in the mortality statistics. This has had a tremendous effect in increasing the expectancy of life at birth. In 1900 the average life expectancy at birth in the United States was forty-seven years; today it exceeds sixty-seven years. For white males the life expectancy is 65.1 years (for non-white 57.5), whereas for white females it is 70.3 (for non-white females 61), which indicates that women on an average live longer than men. This increase in life expectancy has been due chiefly to the reduction in the death rate of persons under forty years of age. Death rates in the latter half of life have fallen very little; people of middle age and over, therefore, have only a little longer life expectation than did their grandparents. The average duration of life has been shifted to a higher age but the upper age limit, which is in the neighborhood of a century, has not been raised.

Students entering college at present are substantially taller and heavier.



have larger chests, are better nourished and have suffered less damage from communicable disease than those who entered college about thirty years ago. The average increase in height has been between 1 and 2 inches in that period.

HEALTH PROBLEMS OF MODERN LIFE

Although modern science has made impressive gains in its combat against disease and in the prolongation of human life, the battle is only partly won for there are still many diseases for which we have no positive controls, and there still exists a large amount of unnecessary sickness. Despite the lower death rate and the increased life expectancy, many of the diseases that took a heavy toll of life in the past are still great killers. Very few people die of the natural degenerative processes of old age; most of them still die from disease. The goal of eradicating disease has not yet been attained. It has been estimated that an average of one week's work is lost through illness by every working man and woman each year. The total of this lost time is equivalent to the full working time of a million workers per year. Almost one-half of the time lost by wage earners is caused by the common cold.

Among the causes of sickness, the respiratory diseases, including the common cold, sinusitis, sore throat, bronchitis, pneumonia and influenza, occupy first place. Other diseases of frequent occurrence are gastrointestinal ailments, rheumatism, gonorrhea and syphilis. The commonest defect in young people is tooth decay. In the age group of fifteen to forty-five, tuberculosis is the major health problem. The tuberculosis death rate reaches a second peak after the age of sixty. Recognition of the dangerous threat tuberculosis still is holding over our people led Congress in 1944 to authorize a National Tuberculosis Control program which empowered the United States Public Health Service, in cooperation with State health authorities, to combat this scourge.

Rheumatic fever is one of the most serious diseases of childhood, usually occurring between the ages of five and fifteen. It often follows streptococcal infections such as sore throat, tonsillitis and scarlet fever, and in many cases does permanent damage to the heart valves. Excluding accidents, rheumatic fever is the chief cause of death among school children. It kills five times as many children as poliomyelitis, measles, diphtheria, whooping cough, scarlet fever and meningitis combined. It is responsible for most of the heart disease in children and much of the heart disease appearing in later life. The death rate from rheumatic fever, however, has taken a downward trend.

Mental illness has become a serious health problem. Young adults and older people are its chief victims. Our highly industrialized, competitive society subjects people to severe physical, mental and emotional strains. It has been estimated that more than 8,000,000 persons in the United States are suffering from some type of mental disorder. Of these, 600,000 are confined in mental hospitals, most of which are badly overcrowded. Mentally warped personalities are responsible for many of the crimes committed daily. In recognition of the need for action against mental disease, Congress passed the National Mental Health Act in 1946. With this legislation the United States government accepted responsibility for a nationwide program to combat mental and emotional disorders.

Large numbers of our citizens fall short of full health in varying degrees. Many are inadequately nourished, due to improper choice of food. Many persons not ordinarily placed in the category of the sick are suffering from physical inefficiency, fatigue, irritability, emotional frustrations and other deviations from good health. These conditions arise chiefly from improper ways of living and erroneous conceptions of individual responsibility in regard to healthful living. Ignorance and indifference are major factors in the occurrence of disease. Education, general as well as in matters pertaining to health, is a necessary foundation for the attainment of a high level of health.

There has been a gradual shift in the age distribution of our population. Due to a declining birth rate, reduction in immigration and an increase in average longevity, the number of older persons is constituting a steadily greater fraction of our total population. In 1900 the number of persons forty-five years of age and over constituted 18 per cent of the population, whereas at present more than 26 per cent of our people are in the middle and older age groups. This trend will continue. It has been predicted that by 1960 about 33 per cent of our population will be forty-five years of age or over. The fact that our population is aging may have important effects on life in the United States a few generations from now. The scientific study of aging in all its aspects is known as *gerontology*, whereas the term *geriatrics* refers to the clinical study and treatment of the ailments of old age. Many people are physiologically older than their chronologic age and some are younger physiologically than their elapsed years.

Aging may be accelerated by the mode of life of the individual. A disrespect toward the basic needs for good health may lead to premature aging. Losing sleep consistently, smoking excessively, consuming too much or an insufficient supply of food, neglecting to obtain sufficient physical activity or violating nature's decrees in other ways, hasten the

aging process. Because human life is limited in span everyone eventually dies. Since relatively more people are now in the older age brackets more people die from the diseases peculiar to maturity and old age. These so-called degenerative disorders are chronic in nature. The most important of the chronic maladies are the cardiovascular diseases which include diseases of the heart, arteriosclerosis and high blood pressure. Other chronic diseases are cancer, kidney diseases, nervous and mental disorders, tuberculosis, diabetes and arthritis. These diseases now are the prime causes of disability or death. It is conservatively estimated that about twenty-five million of our people are afflicted with chronic diseases, resulting in nearly a million deaths annually. Although chronic diseases increase in prevalence with age, it should be noted that these illnesses are not confined to elderly people but occur also in younger individuals. Approximately 16 percent of patients afflicted with chronic diseases are less than twenty-five years of age, and about one half are under forty-five years of age. Most of the chronic diseases of advancing years have their beginning in the middle-age period. Their course is accelerated by the stress and strain of modern life.

The cardiovascular diseases lead all other causes of death. The mortality is very high. Cancer, another of our leading killers, is the second major cause of death. Cancer deaths can be reduced by early diagnosis followed by proper treatment by means of surgery, radium and x-ray. It has been estimated that between 30 and 50 per cent of cancers can be cured if treatment is started early. Periodic medical examinations will reveal the presence of cancer and other deteriorating processes long before they are suspected of being present.

Although not a frequent cause of death, arthritis now victimizes one out of every twenty persons in the United States. Many cases result in crippling and disability. A new drug, cortisone, has been developed which promises to cure or arrest arthritis. However, at present the drug is manufactured in such limited quantities that it is available only for experimental work.

An important factor in the prevention of chronic degenerative disease is the promotion of positive health, physical and mental, throughout life, and intensification of efforts against those communicable diseases which lead to chronic illness. The best insurance against chronic illness is a sound program of healthful living throughout life. The mass methods which proved so effective in the subjugation of many of the communicable diseases are not applicable to the chronic degenerative diseases. The conquest of these diseases undoubtedly will be accomplished by future generations.

THE WORLD HEALTH ORGANIZATION

The World Health Organization came into official existence in 1948 with the signing of its constitution by representatives of sixty-one nations. It is an agency of the United Nations established for the purpose of coordinating and directing international health work. Its objective is to work for the attainment by all peoples of the highest levels of health.

The following sentences are quoted from the preamble of the constitution of W.H.O.: "The health of all people is fundamental to the attainment of peace and security and is dependent upon the fullest cooperation of individuals and States. The achievements of any State in the promotion and protection of health is of value to all. Unequal development in different countries in the promotion of health and control of disease, especially communicable disease, is a common danger. Healthy development of the child is of basic importance; the ability to live harmoniously in a changing total environment is essential to such development."

Problems to be given top priority are malaria, tuberculosis, venereal diseases, maternal and child health, nutrition and environmental sanitation. W.H.O. is organized to furnish medical facilities to member nations, to collect world-wide disease statistics, to serve as a central clearing-house for the rapid exchange of epidemiologic information, to eradicate epidemic and endemic diseases, to encourage and conduct scientific research, to disseminate medical information and to assist in the development of an informed public opinion on matters of health. It is concerned also with the standardization of drugs, biologic preparations, diagnostic procedures and nomenclature with respect to diseases and causes of death.

W.H.O. is a positive force destined to have a far-reaching effect on the world health conditions. It is of importance to the people of the United States since high standards of health in other countries mean greater safety for our people.

HEALTH HABITS AND ATTITUDES

A mere knowledge of hygiene is of little value; the fundamentals of healthful living must be *carried out* if the individual is to profit from them and live a richer and happier life. Nearly every human being will profit by improving his mode of living. It takes wisdom and ingenuity to translate health knowledge into practice. The individual must take an intelligent interest in the business of living and must organize and control his body, mind and emotions so that they will work together as a totality. A high level of health is attainable only through the acquisition of health

habits and attitudes based upon scientific knowledge. To a large degree the health and happiness of each individual is in his own hands. He alone can change his attitude, his thoughts and the pattern of his actions. He alone can incorporate health conservation into his daily thinking and living.

As free individuals our people can manage their lives largely as they see fit, but no one is morally at liberty to jeopardize his health, since to do so is a threat to society. The mode of living of each individual should be so adjusted that he may take his place in the community as a healthy, contented, self-respecting and useful citizen. It is only thus that he can fulfill his obligations to himself and to those who live about him. The health of the community depends on the actions of the individual citizens. The unacceptable health status of many of our young people, revealed by physical examinations made in connection with selective service in the recent war, was due in most cases to lack of proper health habits.

Proper health habits constitute the only sound foundation upon which to build health for it is what we do habitually that determines the level of health we attain. To acquire correct habits of living one needs not only determination but also imagination that will enable one to see the advantages of the habits. It is only when one is thoroughly imbued with the will to form a new habit that there is any hope of acquiring the habit. Through the acquisition of good health habits one acquires the art of living healthfully.

Important as it is to give a reasonable amount of thought and consideration to one's health and to acquire wholesome habits of living, it is inadvisable to take the matter of health too seriously. One should not become overimpressed with his personal health obligations. An abnormal preoccupation about one's health is known as *hypochondria*. A person suffering from hypochondria may resort to morbid self-inspection, brood over non-existent or minor ills, become fearful about developing a heart disorder or some other affliction. The mental attitude of this type of person is inimical to the normal functioning of his body and mind.

It is the purpose of this book to present the principles of healthful living in a practical manner so that the individual readily may apply them to his daily life and thus acquire the *art of living healthfully*.

QUESTIONS FOR CLASS DISCUSSION

1. Explain the significance of the statement "Life does not owe us health any more than it owes us success."
2. What attitude should one take in regard to the present world situation to keep it from having an adverse effect on one's health?

3. Can health be attained by doing one or two specific things or does it require a program of living? Explain.
4. Discuss adjustment to environment in relation to health. What are the important environmental factors to which one must adjust himself?
5. Explain the meaning of the term "health" and give several definitions of the term, including the one formulated by the World Health Organization.
6. State the characteristics of a healthy individual.
7. Define: (a) hygiene, (b) personal hygiene, (c) public health, (d) sanitation, (e) social hygiene.
8. What progress has modern science made against bubonic plague, smallpox, typhoid fever, diphtheria, tuberculosis and infant mortality? State specifically in each case how this has been achieved.
9. State the progress that has been made in the field of therapeutics.
10. Compare the average life expectancy at the beginning of the present century with that of today. What are the factors that have made the present expectancy possible?
11. Has the life expectancy of persons above the age of forty been appreciably increased?
12. Name specific diseases which still constitute a serious menace to human well-being.
13. In which age group is tuberculosis the major health problem?
14. What change is taking place in the age distribution of our population? How will this affect the health problems of the future?
15. Name the two major causes of death.
16. What are the objectives of the World Health Organization?
17. Is health knowledge of any practical value to one if it does not lead to the formation of suitable health habits? Explain.
18. How may one acquire a new habit?
19. Should health be looked upon as an end in itself or does its value lie in its usefulness? Explain.
20. Is it possible to give undue attention to matters of health? Explain.
21. List as many reasons as you can why an individual should strive to attain a high level of health.

TOPICS FOR ORAL OR WRITTEN REPORTS

1. Prepare a brief sketch of the life and achievements (stressing contributions to human welfare) of one of the following: (a) Florence Nightingale, (b) Edward Jenner, (c) Louis Pasteur, (d) Joseph Lister, (e) Walter Reed, (f) William Gorgas, (g) Frederick Banting.
2. Outline the discovery of the role of the anopheles mosquito in the transmission of malaria.
3. Secure the latest available data on physical examinations of college students or other groups, and tabulate the indicated disabilities on a percentage basis.
4. Cogitate on what would happen to civilization if the scientific knowledge of health and disease prevention modern man has laboriously wrung from nature were suddenly abolished.
5. The radio offers opportunity for educating people in health—is it used also in a manner detrimental to health? Ponder this statement and then discuss it.
6. Interview the health officer of your community in regard to the local death rate for typhoid fever last year as compared with twenty-five or thirty years ago. Base a report on the data obtained.

7. Referring to Figure 2 of this chapter, write a brief account of the progress man has made in his fight against tuberculosis.

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CHAPTER 2

Nutritional Needs of the Body



ONE of the most important of human needs is food. The human body is built and regulated by the nutritional ingredients of the food it consumes. What a person eats or fails to eat influences his well-being. Choosing a dietary that will satisfy all the requirements of the body is of paramount importance for normal growth, development and body maintenance. The process of nutrition is a continuous one throughout the life span, beginning in prenatal life. The knowledge we now possess about the nutritive requirements of the human body and the nutritive value of the various foods used in human nutrition is the result of years of painstaking research. It is important not only to learn the facts about nutrition but also to recognize that good nutrition is a prerequisite of good health.

The food consumption of individuals is influenced by emotion, tradition and habit, by personal likes and dislikes, prejudices and irrational ideas, religious customs as well as by economic factors. Food habits usually are not readily changed. Recent dietary studies show that the diets of many people provide food in sufficient quantities to satisfy the appetite and allay hunger but are deficient in certain essential substances such as minerals, vitamins or proteins. Such diets, although they may be only slightly or moderately deficient, will over a period of years seriously affect the well-being of the individual. Inadequacy due to kind of food eaten rather than amount is now frequently designated by the term "hidden hunger," whereas the term "hollow hunger" refers to the ingestion of an insufficient amount of food. It is to the advantage of everyone to acquire an intelligent understanding of the role that food plays in his daily life and to assume the responsibility of selecting a dietary adequate for his needs.

Although our people have become aware of the need for a proper diet and have become "diet conscious," they lack, for the most part, a correct understanding of the dietary needs of the human body. Some knowledge, however, has filtered through to them, but there are many who have not taken practical action to improve the adequacy of their daily food consumption.

NATIONAL SIGNIFICANCE OF NUTRITION

Dietary surveys have revealed that poor nutrition, in all stages from mild to severe, is widespread in the United States. Nutritional deficiencies, directly or indirectly, disqualified many of our young men for military service in the recent war. Since the nutrition of the people influences public health, adequate nutrition is not only an individual responsibility but also a national one. Properly selected foods provide the people of a nation with the physical and mental stamina necessary for a high level of health and a satisfactory life. Improperly selected foods, on the other hand, are responsible for much ill health as well as physical and mental ineffectiveness. Many of the physical defects found in young men and women are traceable directly to nutritional deficiencies. The health of the nation would be greatly improved if the newer knowledge of nutrition were generally applied.

WORLD FOOD SITUATION

The world is not producing enough food for its vast population which is estimated to be two and a quarter billion persons. Many parts of the world are filled to overflowing with human beings. Unless measures are taken to correct this situation it will become progressively worse since the world population is increasing at the rate of twenty million annually. The most urgent need of the world today is food. More than one-half of the world's population—some estimate it as two-thirds—is inadequately fed and pitifully poor. These people are not in a position to know what good health means.

The United States leads the world in food production. For every person in the United States four acres of land are under cultivation, in Russia two acres are cultivated per person, one and a half acres in South America, and less than one acre in western Europe and Asia. Improving the world food situation, admittedly a difficult problem, would be an important step in laying the foundation of permanent world peace.

FOOD COMPONENTS

Foods are used in the body (1) to yield energy for body activities and heat for the maintenance of the normal body temperature, (2) to build and maintain body structures and (3) to coordinate and regulate body processes. Besides *water* and *roughage* (chiefly cellulose) there are five groups of foods included in our daily dietary, namely, (1) carbohydrates, (2) fats, (3) proteins, (4) minerals and (5) vitamins.

Carbohydrates. The carbohydrates are composed exclusively of three elements, carbon, hydrogen and oxygen. The hydrogen and oxygen are present in the same proportion as in water, i. e., two atoms of hydrogen to one of oxygen. They embody a large group of compounds including chiefly starches, sugars and cellulose.

The chief classes of carbohydrates are the following:

I. Sugars

Monosaccharides (simple sugars), $C_6H_{12}O_6$: glucose (dextrose), levulose (fructose), galactose

Disaccharides (double sugars), $C_{12}H_{22}O_{11}$: sucrose (cane sugar), lactose (milk sugar), maltose (malt sugar)

II. Nonsugars

Polysaccharides,¹ $(C_6H_{10}O_5)_n$: starch, glycogen (animal starch), cellulose, pectin, vegetable gums.

Carbohydrates are found chiefly in fruits and vegetables and in a few animal products. Glucose, the most common of simple sugars, occurs in fruits, corn syrup, honey and molasses.

Sucrose (table sugar) is obtained from sugar cane and sugar beets. Lactose (milk sugar) is present in milk, cow's milk containing about 5 per cent. Starch, an insoluble carbohydrate, occurs chiefly in cereals (wheat, oats, rye and rice), peas, beans, squash, pumpkin and tubers and root vegetables (potatoes, beets, turnips and parsnips). Glycogen (animal starch) is found in animal livers and muscles, and is the form in which the animal organism stores carbohydrates. Cellulose is the chief constituent of the leaves and stems of plants and the outer coverings of seeds. It is not digested in the body but serves the useful purpose of providing bulk (roughage) to the intestinal contents. The chief sources of carbohydrates are plants, where they originate from carbon dioxide and water in the process of photosynthesis.

Carbohydrates furnish the bulk of human food. They are the chief source of human energy, providing from 50 to 60 per cent of the energy of the body. The primary energy food is glucose since the body converts all other carbohydrates into glucose. In the liver glucose is converted into glycogen and stored temporarily in that form. The liver reconverts glycogen into glucose at a sufficient rate so that the blood will at all times contain approximately 0.1 per cent of glucose. The cells of the body utilize glucose in their energy metabolism. Excess glucose can be converted into fat and stored in that form.

Fats. Fats, like carbohydrates, are composed of carbon, hydrogen and

¹ The molecular structure is not completely known but is believed to be some multiple of $C_6H_{10}O_5$.


oxygen, but contain relatively little oxygen. This gives them a higher energy value than the carbohydrates. Fats are combinations of fatty acids and glycerin. Oils are fats in liquid form. Fats belong to a heterogeneous group of compounds known as *lipids*. Examples of foods from animal sources that provide fats are meat, fish, egg yolk, lard, butter, cream and cheese. In the plant kingdom, seeds and nuts are rich sources of fats. Many of the vegetable fats, such as cottonseed oil, corn oil and coconut oil, are used in salad dressings and as butter substitutes. Peanut butter is about 45 per cent fat. Mineral oil, which is a petroleum product, is not digested in the body and is, therefore, devoid of food value.

Fats are used in the body chiefly for the production of energy. When oxidized they yield two and one-fourth times as much energy as the same amount of carbohydrates. It is interesting to note that fats can be oxidized completely only when some carbohydrate is present. Aside from their high energy value certain fats are important because they serve as carriers of the fat-soluble vitamins A, D, E and K. Fats also furnish essential fatty acids which are needed in the body for the health of the skin and other tissues.

Little information is available concerning the amount of fat required by the human body. It is recommended by the National Research Council that fat be included in the diet to the extent of at least 20 to 25 per cent of the total calories. For children and adolescents and very active adults it is recommended that 30 to 35 per cent of the total calories be derived from fat. Excess fat can be stored beneath the skin, in bone marrow and in the abdominal cavity, serving as reserve fuel.

Proteins. Proteins are very complex organic compounds which play an important part in the structure of protoplasm, the living substance of which all cells are composed. Next to water, proteins are the most abundant components of protoplasm. The word "protein" has been derived from a Greek word meaning to take first place, and was chosen because of the importance of this group of compounds in the structure and activities of protoplasm. All the living parts of the body are largely protein. Directly or indirectly they are involved in most of the chemical reactions occurring in protoplasm. There are many different kinds of proteins, all of which contain carbon, hydrogen, oxygen and nitrogen. Many contain small amounts of sulfur and some have phosphorus. A few contain small amounts of other elements.

Proteins are absolutely essential to tissue growth and upkeep. In addition, they provide the necessary material for the construction of enzymes and hormones, on whose normal activity the orderly functioning of the



body largely depends. They also play an important role in maintaining the fluid balance of the body. The body can utilize proteins for the production of energy. Between 10 and 15 per cent of body energy is normally provided by proteins.

Proteins are made up of varying combinations of nitrogen containing acids known as *amino acids*. About two dozen different amino acids have been isolated from the hydrolysis of a variety of proteins. Each kind of protein has its own individual amino acid composition. Different assortments and arrangements of amino acids make different proteins. Only a few kinds of proteins contain all of the known amino acids.

The cells of the human body can synthesize many of the amino acids they need. Those that cannot be synthesized must be supplied in the foods eaten. It is now believed that eight of the needed amino acids are incapable of synthesis by the body. They are commonly designated as the "essential" or "indispensable" amino acids. These amino acids have acquired a prestige comparable with that of the vitamins in maintaining normal nutrition and life processes. Arginine and histidine, formerly considered indispensable, are now placed in the dispensable group. Proteins containing all of the essential amino acids are said to be of high biologic value and are also referred to as "complete" proteins. The following are commonly considered as being the essential amino acids in human nutrition:

Lysine	Phenylalanine
Leucine	Threonine
Isoleucine	Methionine
Tryptophane	Valine

In general, proteins of animal origin (meat, poultry, fish, eggs, milk and cheese) are of high biologic value whereas those in plant materials (wheat, corn, oats, dried peas, beans and nuts) are less complete and many of these lack essential amino acids. The proteins in soy beans, however, are of high quality. It is not necessary that all of the proteins ingested be complete since incomplete proteins from one source combined with incomplete proteins from another source may supplement one another in such a way that the body will be provided with all the amino acids needed to build human proteins.

The best source of proteins of high biologic value are: organ meats (liver, kidney, sweetbreads), milk, eggs, muscle meat and soy beans. Gelatin, although an animal protein, is deficient in tryptophane, one of the indispensable amino acids. The cereal foods, although containing relatively small amounts of proteins, contribute substantial amounts to our

food intake because of the large total quantities of these foods usually included in the human dietary.

To allow for a reasonable factor of safety, the Food and Nutrition Board of the National Research Council² recommends for adults approximately 1 gm. of protein per day for every kg. (2.2 lb.) of body weight. Many people can remain in health with less than this allowance. There are no differences in the requirements for sedentary, moderately active or active adults. Physical activity calls for additional calories which are more economically supplied by carbohydrates. Table 1 gives the daily protein requirements for adults and children.

TABLE 1
DAILY PROTEIN NEEDS FOR ADULTS AND CHILDREN

	<i>Grams</i>
Average man (154 lb., 70 kg.)	70
Average woman (125 lb., 56 kg.)	60
Pregnancy, latter half, averaged-sized woman	85
Lactation, average-sized woman	100
Children 1-3 years (27 lb., 12 kg.)	40
4-6 years (42 lb., 19 kg.)	50
7-9 years (58 lb., 26 kg.)	60
10-12 years (78 lb., 35 kg.)	70
Children more than 12 years of age:	
Girls 13-15 years (108 lb., 49 kg.)	80
Girls 16-20 years (122 lb., 55 kg.)	75
Boys 13-15 years (108 lb., 49 kg.)	85
Boys 16-20 years (141 lb., 64 kg.)	100

The daily protein requirements for an adult are usually met if the dietary includes one serving of either meat, fish or egg, one pint of milk and a serving of cheese, together with the cereal foods and vegetables usually consumed. A pint of milk furnishes nearly one fourth of the day's protein needed by an adult male of average weight. The prevalence of protein deficiency in the dietaries of our people is not definitely known. Nutritional surveys, however, indicate that protein deficiency is common in some parts of the United States and among many persons in the lower income groups. The results of protein deficiency are ease of fatigue, retarded growth in children, muscular weakness and increased susceptibility to infectious disease. Pronounced deficiency causes edema.

² The Food and Nutrition Board of the National Research Council has a membership of approximately fifty top-ranking specialists from agriculture, industry and the sciences dealing with food and nutrition. It came into being in 1940. Its chief function is to serve in an advisory capacity on problems of nutrition.

Minerals. The mineral elements are inorganic substances. They remain wholly or in part in the form of ash when food is burned and are therefore sometimes referred to as “ash.” The mineral elements which occur in relatively large amounts in foods are calcium, phosphorus, potassium, magnesium, sodium, iron, sulfur and chlorine. Those present in very small amounts are sometimes called “trace” elements. Examples of these are iodine and copper. Minerals occur in foods in the form of inorganic salts or in combination with organic substances. They are essential constituents of body cells, make up a large percentage of certain structures of the body such as bones and teeth, and some serve in the regulation of body processes. They maintain the normal alkalinity of the blood, influence the irritability of nerves and muscles, and regulate the rhythmic

TABEL 2
PROTEIN CONTENT OF SOME COMMON FOODS

<i>Food</i>	<i>Amount</i>	<i>Grams</i>
Bread, white	1 slice	2.1
Whole wheat	1 slice	2.7
Banana	1 medium	1.2
Beans, baked	½ cup	6.0
Cheese, cottage	½ cup	19.2
Cheddar	1 oz., 1 avg. serving	6.8
Corn flakes	1⅓ cup	2.2
Egg	1 medium	6.4
Fish	3½ oz., 1 avg. serving	24.0
Ice cream	⅙ qt.	4.0
Meat, lean	3½ oz., 1 avg. serving	20.0
Milk, whole	1 pt.	16.8
Oatmeal	⅔ cup, cooked	4.9
Peanut butter	1 tbsp.	4.0
Peas, canned green	½ cup	3.4
Potato, white, baked	1 medium	3.0

action of the heart. Calcium and phosphorus give strength and rigidity to bones and teeth.

Minerals are being excreted constantly from the body and must be replaced. Most of the mineral elements are required in very small quantities and are usually present in ample amounts in the foods generally used. A few such as calcium, phosphorus and iron are required in larger quantities so that a dietary may be deficient in these elements if it has not been carefully chosen. Iodine, although required in only small amounts, may also be deficient in the dietary.

Calcium is one of the most important mineral elements required by the body. It contributes to the formation of bones and teeth, helps to clot

blood and aids in the regulation of the heart beat. If a deficiency of this mineral occurs in the dietary, calcium is withdrawn from the bones to maintain the normal level in the blood. Calcium phosphate and calcium carbonate comprise most of the mineral matter present in bones and teeth.

Foods rich in calcium are milk, cheese, egg yolk, green, leafy vegetables, peanuts, oatmeal, peas and beans (especially soy beans). The allowance recommended by the Food and Nutrition Board of the National Research Council for a normal adult is 1 gm. per day. Since dietary studies show that calcium is often deficient in American meals it is advisable to assure a safe margin of calcium intake at all times. The daily requirement can be met with 1 pint of milk, 2 servings of vegetables, 6 slices of whole grain bread, 2 servings of fruit and 1 egg. A quart of milk supplies the daily requirement.

Phosphorus as well as calcium is needed in bone and tooth formation. It is present in the nuclei of cells and in the blood, and participates in many of the chemical reactions of the body. Among the best dietary sources are milk, eggs, cheese, meat, fish, whole wheat, bran, beans, peas, oatmeal and peanuts. The daily intake of phosphorus should be somewhat greater than that of calcium, about 1.5 gm. If the calcium and protein needs are met, the phosphorus requirement also will be covered because foods high in calcium and proteins are good sources of phosphorus.

Iron is an essential part of protoplasm and is present in minute quantities in all of the cells of the body, but the greater part (about 80 per cent) is concentrated in hemoglobin, the iron-containing protein of red blood corpuscles. Hemoglobin gives blood its red color and enables it to transport oxygen from the lungs to the cells of the body. The presence of copper is necessary for the formation of hemoglobin. The iron in some foods is more readily assimilated than that in others. Among the best food sources are organ meats, particularly liver, egg yolk, muscle meat, dried fruits, cereals and molasses. A small serving of beef liver will provide about one-half of the daily iron requirement.

A deficiency of iron in the food intake for a period of time causes anemia. The average adult excretes about 12 mg. of iron daily which must be replaced by an equivalent daily ingestion of iron. The daily requirement may be fulfilled by one serving of beef, 6 slices of whole grain or enriched bread, 1 egg, 1 serving of potato, 2 servings of fruit and 2 servings of vegetables. Milk is a poor source of iron.

Iodine is utilized almost entirely by the thyroid gland for the production

of the hormone, thyroxin, which contains 65 per cent iodine. The iodine combines with the amino acid, tyrosine, to form the thyroid hormone. The thyroid gland controls the rate of energy metabolism and the rate of growth. A lack of iodine in the diet causes the thyroid gland to become enlarged in an effort to compensate for the iodine deficiency. This condition is known as simple goiter. There is a large area in the United States in which the soil is deficient in iodine. This includes the Great Lakes area and much of Minnesota, the Dakotas, Colorado and the Pacific Northwest.

The iodine requirement is small, only about 0.002 to 0.004 mg. a day for each kg. of body weight or 0.15 to 0.30 mg. daily for the adult. The use of iodized table salt will usually provide the amount needed. Iodine is present also in fish liver oils, sea foods, and green vegetables and fruits grown in soil containing iodine.

Other minerals are usually present in sufficient amounts in the usual diet. The average adult requires about 5 gm. of sodium chloride (table salt) but the average daily intake is 10 to 15 gm. During excessive perspiring enough salt may be lost to cause weakness and nausea. Under such conditions it is advisable to increase the salt intake.

Vitamins. Vitamins are organic nutritional factors required in very small amounts for the performance of varied specific functions which are essential in the maintenance of the physiologic equilibrium of the body. They are present in natural foods in small quantities and are indispensable for the normal functioning of the organs of the body. Foods that have been processed and refined are often poor in vitamins.

There are a large number of vitamins which are necessary for a satisfactory diet. The realm of vitamins has not yet been thoroughly explored; there are still many uncertainties. Not all of the physiologic activities of vitamins are known, nor are all the vitamins needed in human nutrition known at the present time.

In recent years vitamins have been highly publicized and their relative importance overemphasized. This has led to a disregard, on the part of many individuals, of other nutritional factors which are equally important in the human bill of fare. Taking vitamin capsules may give the individual a false sense of security and may tend to make him negligent in regard to choosing an adequate dietary. Notwithstanding the daily word barrage of vitamin advertising, taking prepared vitamins does not insure an adequate diet. The vitamins which are included in the multi-vitamin preparations on the market are not all of the vitamins required by the body. The person who gets his vitamins from the foods he eats gets the known as well as the unknown. Nothing but food will give a complete supply. A haphazard diet plus commercial vitamin preparations is not a

well-balanced diet. To insure an adequate diet one must go to the basic sources of vitamins, minerals, proteins and calories.

For the maintenance of health, adequate amounts of the various vitamins must be present in the diet. In the absence of an adequate intake of vitamins, definite symptoms manifest themselves. Examples of vitamin deficiency diseases, or *avitaminoses*, are scurvy, beriberi, xerophthalmia, rickets and pellagra. Many people receive inadequate amounts of vitamins, either because they do not eat enough of the foods that are good sources of vitamins or eat foods that have lost, through improper preparation, their normal content of these essential nutrients.

When vitamins were first discovered they were designated by letters of the alphabet because their chemical composition was unknown. Now many of the vitamins have been identified chemically and have been given individual names just as have other chemicals. Certain ones, although their chemistry is known, are still referred to by letters. Because these vitamins exist in three or more forms, the use of their scientific names for ordinary purposes would be confusing. This is particularly true of the fat-soluble vitamins. The amount of a certain vitamin present in a given quantity of a certain food is expressed either in weight or in units known as "international units." U.S.P. units are equivalent to international units. The weight units are either milligrams or micrograms. A milligram is equal to one-thousandth of a gram, while a microgram is equal to one-thousandth of a milligram.

Vitamin A is a fat-soluble compound needed for growth in children and for the health of epithelial tissues of all ages. Epithelial tissues are those that are specialized for covering internal and external surfaces; they include the skin and the mucous membranes that line the digestive tract, respiratory tract, urinary bladder and other body cavities. This vitamin is necessary also for the proper formation of tooth enamel and for normal vision.

The lack of vitamin A over a period of time causes the skin to become dry, scaly and rough with a tendency to infection, and brings about a degeneration of the mucous membranes. Vitamin A deficiency also leads to poor vision in dim light (so-called "night blindness"), a condition in which the retina of the eye does not adjust itself properly to changes in light intensity, and dry eyes (xerophthalmia), a disease in which the tear glands cease their secretion causing the eyes to become dry, inflamed and ulcerated.

The human eye contains a photosensitive pigment in the retina, known as visual purple, which is composed of vitamin A combined with protein.

Visual purple is necessary for vision in dim light, but is not needed for vision in bright light. It is changed chemically by light but is constantly regenerated due to the presence of vitamin A. In the condition known as night blindness the period of regeneration is longer than normal. Bright lights, such as the glare of approaching headlights on the highway, delay the regeneration of visual purple for a number of seconds. During this brief period vision is impaired. It is hazardous for a night-blind person to drive an automobile at night. About 10 per cent of American drivers are deficient in vitamin A to an extent to make them night-blind.

Vitamin A does not occur in plants. Certain plants, however, contain a yellow pigment which when taken into the human body is converted by the liver into vitamin A. This pigment is called *carotene* because it was first isolated from carrots. Because it is transformed in the body into vitamin A, carotene is a provitamin. The yellow colors of many vegetables, such as carrots and sweet potatoes, as well as of certain fruits, are due to carotene. The green leafy vegetables also contain this pigment, but the yellow color is masked by chlorophyll which is green. In the tomato a red pigment conceals the carotenoid pigment. The vitamin A value of fruits and vegetables is due to their carotenoid pigments.

Among the green vegetables, peas, string beans, green peppers, asparagus, celery and broccoli have a high provitamin A content. Among the yellow vegetables and fruits, excellent sources are carrots, sweet potatoes, yellow peaches, apricots and yellow corn. Milk, cream, butter and egg yolk are good sources of vitamin A. They generally contain some carotenoid pigments due to the fact that in the animal body the conversion of the pigments into vitamin A is usually not complete. Other good sources are liver and salmon. The most potent sources are the fish-liver oils. Cod liver oil contains about 1000 units of vitamin A per gram (about 4000 units in a teaspoonful) ; halibut liver oil, 10,000 units per gram; and the liver oil of fish belonging to the group known as *Percomorphi* contains about 60,000 units per gram.

The average daily requirement for an adult has been estimated to be 5000 international units. A representative combination of foods that would supply this amount are: $\frac{3}{4}$ quart of milk, 1 tablespoonful of butter, 1 egg, $\frac{3}{4}$ cup of tomatoes, $\frac{3}{4}$ cup of string beans, and $\frac{1}{2}$ of a medium sweet potato. Vitamin A withstands ordinary cooking temperatures but gradually loses its potency on exposure to both air and high temperatures. Commercial canning procedures do not appreciably reduce the vitamin A potency of foods. This vitamin can be stored in the body in relatively large amounts, chiefly in the liver.

Table 3 contains a selected list of common foods which are good sources of vitamin A. It gives the vitamin A values in international units of portions commonly served or used.

TABLE 3
VITAMIN A IN FOOD PORTIONS COMMONLY USED*

<i>Food</i>	<i>Amount</i>	<i>International Units</i>
Apricot, canned	2 halves	450
Asparagus, canned, green	4 to 5 small tips	300
Banana	1 medium	430
Beans, snap, canned	½ cup, drained	410
Beet greens	½ cup, cooked	6,700
Broccoli	½ cup, cooked	3,500
Butter	1 tbsp.	429
Cantaloupe	½ of a 4½" melon	5,130
Carrots, raw or canned	⅔ cup	12,000
Chard, Swiss	½ cup	2,800
Cheese, cheddar	1 oz., avg. serving	493
Cottage	½ cup	30
Cream	1 oz.	627
Cod liver oil	1 tsp.	4,000
Collards	½ cup, cooked	6,870
Corn, sweet, yellow	½ cup, canned	200
Dandelion greens	½ cup, cooked	13,650
Egg	1 medium	570
Endive	5 long leaves	900
Escarole	2 leaves, large	5,000
Halibut liver oil	1 capsule	5,000
Ice cream	⅙ qt.	513
Kale	½ cup, cooked	7,540
Lettuce, head	1 large leaf	162
Liver, beef	2"x2"x¼"	9,000
Milk, whole	½ pt.	384
Peach, canned	2 halves	450
Peas, canned, green	½ cup	540
Peppers, green	1 medium	630
Pumpkin, canned	½ cup	3,400
Spinach, canned	½ cup	6,790
Sweet potatoes, baked	1 large	8,287
Tomato juice	½ cup	1,050
Turnip greens	½ cup, cooked	9,540

* Based on data in "Food Values of Portions Commonly Used" by A. Bowes and C. Church. This applies also to the other vitamin tables in this chapter.

The original vitamin B which was thought to be one substance has been found to contain a dozen or more factors, differing in chemical structure, the best known of which are thiamine, riboflavin and niacin. This group is called the *vitamin B complex*. Some of the other members of the group

are para-aminobenzoic acid, inositol, pantothenic acid, pyridoxine, choline, biotin and folic acid. There are probably more awaiting discovery.

Thiamine,³ also known as vitamin B₁, is essential for growth and development, normal appetite, the maintenance of muscle tone, particularly of the digestive system, and the normal functioning of the cardiovascular and nervous systems.

Thiamine is indispensable in the oxidation of glucose. In the body it becomes thiamine pyrophosphate, a coenzyme, which means that it becomes a part of an enzyme system of relatively simple structure. In the oxidation of glucose, lactic acid is produced, but one of the intermediate products preceding the formation of lactic acid is pyruvic acid. Thiamine pyrophosphate breaks down pyruvic acid and thus plays an essential role in the oxidation of glucose which is the most important type of energy metabolism occurring in the body.

Shortage of this vitamin in the diet results in the accumulation of pyruvic acid in body tissues until toxic concentrations are reached. The early symptoms of deficiency are loss of appetite, lack of energy, disturbed heart action, digestive disturbances, sluggishness of the muscles of the intestinal wall, anxiety and mental depression. Damage results to the nervous and cardiovascular systems.

Pronounced deficiency causes beriberi, a disease which has been known for many centuries, particularly in the Orient. The disease is still common in the Far East in populations whose staple food is milled rice. In this disease there is a degeneration of the nerves and damage is done to the heart. Pigeons and other birds fed on polished rice develop a related disease, polyneuritis (avian beriberi).

Ordinary cooking processes cause some destruction of thiamine. If soda is added during cooking more of the vitamin is destroyed. Being water-soluble, much of it is lost if the water in which foods are cooked is discarded, especially when large quantities of water are used and the solution is alkaline. Many foods are sources of thiamine but only a few have generous quantities. It is present in whole grain cereals (chiefly in the embryo and the bran), lean meat, especially pork, liver, eggs, peanut butter, vegetables (root and green leafy) and fruits. The present-day enriched flour and bakery products made from it are good sources of thiamine. It is advisable to use an adequate supply of whole grain or enriched flour

³ Although this word is sometimes spelled without the final "e," the United States Pharmacopoeia has adopted the spelling "thiamine" for this vitamin to indicate the chemical characteristics of the compound.

and bread as well as whole grain or enriched breakfast foods. The diet must be selected with care to assure an adequate amount. Food fads or improperly planned reducing diets may be responsible for thiamine deficiency. Yeast is a source of thiamine which, however, is not available

TABLE 4

THIAMINE IN FOOD PORTIONS COMMONLY USED

<i>Food</i>	<i>Amount</i>	<i>Milligrams</i>
Asparagus, canned	4 to 5 tips	0.03
Banana	1 medium	0.09
Beans, baked	½ cup	0.05
Snap, canned	½ cup	0.03
Beef, round, fried	3½ oz., avg. serving	0.12
Bread, white	1 slice	0.02
Enriched white	1 slice	0.06
Whole wheat	1 slice	0.08
Broccoli, cooked	½ cup	0.09
Cabbage, raw	⅔ cup	0.04
Cantaloupe	½ medium	0.09
Carrots, raw	1 large	0.07
Collards, cooked	½ cup	0.22
Corn, sweet, yellow	½ cup	0.02
Egg	1 medium	0.05
Ham, boiled	3½ oz., avg. serving	1.00
Ice cream	⅓ qt.	0.04
Kale, cooked	½ cup	0.12
Liver, beef	2"x2"x¼"	0.10
Milk, whole	½ pt.	0.10
Orange juice, fresh	½ cup	0.08
Peanut butter	1 tbsp.	0.03
Peas, canned, green	½ cup	0.11
Peppers, green	1 medium	0.07
Pineapple juice	½ cup	0.05
Pork loin, roasted	3"x2"x⅛"	0.24
Potato, white, baked	1 small	0.10
Sweet, baked	1 large	0.14
Prunes, stewed	4 or 5 medium	0.05
Rice, brown, cooked	¾ cup	0.09
White, cooked	¾ cup	0.02
Tomato juice	½ cup	0.05
Wheat germ	1 tbsp.	0.20
Yeast, compressed	1 cake	0.05

unless it is boiled or dried. The eating of live yeast deprives the body of thiamine because the yeast cells help themselves to the thiamine present in the intestinal tract.

Since this vitamin is involved in carbohydrate metabolism the greater the amount of carbohydrate consumed and utilized, the greater the amount of thiamine required. The recommended allowance is 0.5 mg. for

each 1000 calories of food intake at ordinary levels of calorie requirements. For a person whose normal caloric intake is 3000, the thiamine allowance should be increased 0.2 mg. for each additional 1000 calories. The requirement for a sedentary adult male is 1.2 mg., for a sedentary

TABLE 5

RIBOFLAVIN IN FOOD PORTIONS COMMONLY USED

<i>Food</i>	<i>Amount</i>	<i>Milligrams</i>
Asparagus, canned	4 to 5 tips	0.05
Banana	1 medium	0.06
Beans, baked	1½ cup	0.05
Snap, canned	1½ cup	0.05
Beef, round, fried	3½ oz., avg. serving	0.15
Bread, white	1 slice	0.02
Enriched white	1 slice	0.04
Whole wheat	1 slice	0.04
Broccoli, cooked	½ cup	0.21
Cabbage, raw	⅔ cup	0.03
Cantaloupe	½ medium	0.06
Carrots, raw	1 large	0.06
Cheese, cheddar	1 oz., avg. serving	0.14
Collards, cooked	½ cup	0.20
Corn, sweet, yellow	½ cup	0.05
Egg	1 medium	0.16
Ham, boiled	3½ oz., avg. serving	0.20
Ice cream	⅙ qt.	0.19
Kale, cooked	½ cup	0.35
Liver, beef	2"x2"x1¼"	1.15
Milk, whole	½ pt.	0.41
Orange juice, fresh	½ cup	0.03
Peanut butter	1 tbsp.	0.02
Peas, canned, green	½ cup	0.06
Peppers, green	1 medium	0.04
Pineapple juice	½ cup	0.02
Pork loin, roasted	3"x2"x1⅛"	0.05
Potato, white, baked	1 small	0.04
Sweet, baked	1 large	0.09
Prunes, stewed	4 or 5 medium	0.08
Rice, brown, cooked	¾ cup	0.02
White, cooked	¾ cup	0.01
Tomato juice	½ cup	0.03
Wheat germ	1 tbsp.	0.08
Yeast, compressed	1 cake	0.25

adult female 1.0 mg. Children between the ages of twelve and twenty need somewhat larger amounts. The daily requirement can be met by the following combination of foods: 6 slices of whole wheat or enriched bread, 1 baked potato, 1 pint of milk, 1 serving of pork, 2 servings of vegetables, 1 serving of whole grain cereal, 1 egg, ¾ cup of orange juice and ⅓ cup of baked beans.

Riboflavin is an orange-yellow, water-soluble compound which exhibits a characteristic yellow-green fluorescence. In the body, together with a protein, it becomes a component of a compound that functions as one of the oxidative enzymes. Symptoms of riboflavin deficiency are: cracks and sores at the corners of the mouth and on the lips; various eye disorders, such as poor vision, abnormal sensitivity to bright light and development of blood vessels in the cornea; opacity of the cornea; impaired digestion and general weakness. In animal experimentation deficiency causes early aging and shortening of the life span.

Liver, kidney, sweetbreads, eggs, milk, legumes and green leafy vegetables have a relatively high riboflavin content. Muscle meats contain some of the vitamin but the cereal grains have very little. Riboflavin is not readily destroyed in cooking. The daily requirement for an adult male is 1.8 mg., and 1.5 mg. for an adult female. The following selection of foods will meet the daily needs: 1 pint of milk, 2 servings of vegetables, 1 serving of meat, 2 medium potatoes, 2 servings of fruit, 1 egg, 6 slices of whole grain bread, and 2 tablespoonfuls of peanut butter.

Niacin, also known as nicotinic acid, is a component of two important cellular coenzymes which function in the process of oxidation. The deficiency disease associated with a lack of this vitamin is known as pellagra. This avitaminosis is characterized by a dermatitis in the form of a rough, red skin, and an inflammation of the tongue in conjunction with serious digestive disturbances, nervous irritability and mental depression. It occurs chiefly in regions where the general standard of nutrition is low and where corn is the staple cereal. It is believed that corn contains a substance that interferes with niacin utilization. In the United States most cases appear in the Southeastern states in the spring of the year. The diet of many people in this area consists chiefly of corn meal, hominy, fat pork and molasses. Pellagra is a disease in which lack of niacin appears to be the predominant factor, but in which other vitamins, especially of the B group, are depleted to a level of physiologic inadequacy.

Good sources of niacin are liver, lean meats, milk and vegetables. The daily requirement for a sedentary man is 12 mg., for a sedentary woman, 10 mg. Muscular activity increases the requirement somewhat.

Vitamin C, or *ascorbic acid*, is needed in the body to promote normal growth of the bones and teeth and to maintain health of the gums and the normal condition of the capillary walls. It affects these structures chiefly because they as well as other parts of the body contain connective tissue fibers. These fibers are interposed between the cells of the various tissues and serve as binding structures. In the capillaries they hold to-

gether the single layer of cells that make up the walls of these the smallest of the blood vessels. With a weakening of this support, leaks develop permitting blood to escape into surrounding tissues. In the absence of vitamin C the connective tissue fibers become weakened.

TABLE 6
NIACIN IN FOOD PORTIONS COMMONLY USED

<i>Food</i>	<i>Amount</i>	<i>Milligrams</i>
Asparagus, canned	4 to 5 tips	0.40
Banana	1 medium	0.60
Beans, baked	1½ cup	0.88
Snap, canned	1½ cup	0.30
Beef, round, fried	3½ oz., avg. serving	5.30
Bread, white	1 slice	0.20
Enriched white	1 slice	0.55
Whole wheat	1 slice	0.98
Broccoli, cooked	½ cup	0.90
Cabbage, raw	⅔ cup	0.15
Cantaloupe	½ medium	1.20
Carrots, raw	1 large	0.50
Egg	1 medium	0.05
Ham, boiled	3½ oz., avg. serving	5.00
Ice cream	⅙ qt.	0.10
Liver, beef	2"x2"x¼"	6.00
Milk, whole	½ pt.	0.24
Orange juice, fresh	½ cup	0.20
Peanut butter	1 tbsp.	2.43
Peas, canned, green	½ cup	0.90
Peppers, green	1 medium	0.40
Pork loin, roasted	3"x2"x⅛"	1.06
Potato, white, baked	1 small	1.18
Sweet, baked	1 large	1.13
Prunes, stewed	4 or 5 medium	0.85
Rice, brown, cooked	¾ cup	1.38
White, cooked	¾ cup	0.42
Salmon, canned, red	1 cup	6.50
Tomato juice	½ cup	0.70
Wheat germ	1 tbsp.	0.46
Yeast, compressed	1 cake	3.38

The most frequent early indications of mild vitamin C deficiency are gingivitis (inflammation of the gums) accompanied by loss of weight, vague pains in the extremities and mild anemia. Lack of this vitamin produces scurvy which is characterized by swelling and bleeding of the gums, loosening of the teeth and soreness and swelling of the joints.

Vitamin C is found chiefly in fresh fruits and vegetables. Raw green peppers rank first as a source of this vitamin. It is abundantly present in the citrus fruits—oranges, lemons and grapefruit. Many other fruits as

well as berries contain large amounts of this vitamin, as do tomatoes (raw or cooked) and raw cabbage. Cooked spinach and cooked potatoes are fairly good sources of vitamin C.

Vitamin C is readily destroyed by oxidation, especially during cooking. Prolonged cooking, storing and aging of foods destroys it. In alkaline solutions the loss is much greater. Acids tend to protect it. In acid foods such as tomatoes and grapefruit, cooking has little destructive effect because of the protective action of the acids present. Frozen foods do not

TABLE 7
VITAMIN C IN FOOD PORTIONS COMMONLY USED

<i>Food</i>	<i>Amount</i>	<i>Milligrams</i>
Apple	1 small	5
Banana	1 medium	10
Beet greens, cooked	1½ cup	34
Broccoli, cooked	1½ cup	118
Cabbage, raw	2⅓ cup	26
Cantaloupe	1½ medium	50
Chard, Swiss	1½ cup	38
Grapefruit	1½ cup	40
Grapefruit juice, canned	1½ cup	35
Lemon juice, fresh	1½ cup	45
Milk, whole	1½ pt.	2
Orange juice, fresh	1½ cup	49
Peaches, canned	2 halves	4
Pears, canned	2 halves	2
Peas, canned, green	1½ cup	8
Peppers, green	1 medium	120
Pineapple juice, canned	1½ cup	9
Potato, white	1 medium	22
Sweet	1 large	28
Spinach, canned	1½ cup	14
Strawberries	10 large	60
Tomato juice, canned	1½ cup	16
Turnip greens, cooked	1½ cup	136

appear to suffer any loss of ascorbic acid. Milk loses from one-fourth to one-third of its vitamin C in the process of pasteurization. The taking of aspirin tends to destroy this vitamin in the body. The daily human requirement is 75 mg. Three-fourths of a cup of orange juice provides this amount. The body stores little if any of this vitamin.

Vitamin D has the function of controlling the absorption of calcium and phosphorus from the intestinal tract, and helping to maintain the normal level of these elements in the blood. Also, it controls the utilization of these elements in the body and thus plays a part in the building of bones and teeth.

In infants and young children a prolonged deficiency of this vitamin results in rickets and impaired dentition, while in older children and adults it gives rise to softening of the bones (osteomalacia).

Neither plants nor animals synthesize vitamin D. This vitamin is formed by the action of ultraviolet rays upon certain compounds known as sterols. Among such compounds are: ergosterol, found in plants, including yeasts, and cholesterol present in the animal skin and other tissues. These activated sterols represent vitamin D substance. Consequently more than one substance possessing vitamin D activity exists. Activation of ergosterol produces calciferol or vitamin D₂ whereas activation of cholesterol gives rise to vitamin D₃ which is commonly known as animal vitamin D. It is this vitamin that is produced by the action of ultraviolet rays on the skin. Fish liver oils apparently contain chiefly vitamin D₃. These various forms of vitamin D, although chemically not identical, apparently produce identical physiologic effects. For this reason the term "vitamin D" is commonly used in the singular form.

As mentioned previously, the human skin contains sterols which upon exposure to the sunlight, or some other source of ultraviolet radiation, are transformed into vitamin D. Because of its limited distribution in foods, nature apparently intended man to get the vitamin D he requires by exposure to sunlight.

Only a few foods contain vitamin D. Fish liver oils, in which vitamin D is associated with vitamin A, are the most potent natural sources. Other sources are liver, egg yolk, salmon and other fish containing much body oil. Another source is a commercial preparation known as viosterol which is produced by irradiating ergosterol obtained from yeast and dissolving it in a vegetable oil. It has a vitamin D potency of 250 times the standard cod liver oil. Certain foods may be fortified with vitamin D. One method is to expose them to ultraviolet rays. This converts the sterols they contain into vitamin D. Another method is to add a vitamin D concentrate to the food. When milk is irradiated to produce vitamin D milk it is exposed in a thin layer to strong ultraviolet light. Much of the vitamin D milk on the market is prepared by adding a vitamin D concentrate to the milk. Another procedure sometimes used in the enrichment of milk is to feed irradiated yeast to cows. Much of the absorbed vitamin D is passed on into the milk. The use of vitamin D milk is a very effective means of increasing the daily vitamin D intake.

Although the actual requirement of vitamin D has not been determined, 400 units per day has been found to be ample for children. Adults apparently need less but the exact requirement is not known. Those who ex-

perience very little exposure to sunlight may not receive enough unless they use vitamin enriched foods or use fish liver oil as a dietary supplement. A teaspoonful of standard cod liver oil, which contains a minimum of 85 units per gram, will provide about 370 units. Vitamin D is stable to heat and is not readily destroyed by oxidation. The body can store relatively large quantities of vitamin D, chiefly in the liver, but the skin, bones and other tissues can also hold significant amounts.

Other vitamins and vitamin-like substances have been discovered. Some of these are known to be necessary in human nutrition whereas others have been found to be necessary for certain animals; however, their need

TABLE 8

VITAMIN D IN FOOD PORTIONS COMMONLY USED

<i>Food</i>	<i>Amount</i>	<i>Milligrams</i>
Butter	1 tbsp.	5
Cod liver oil	1 tsp.	370
Cod liver oil concentrate	1 tablet	370
Egg	1 medium	45
Halibut liver oil	1 capsule	145
Liver, beef	2 oz.	27
Milk, whole	$\frac{1}{2}$ pt.	5
Percomorph liver oil	$\frac{1}{4}$ tsp.	8500
Salmon, red, canned	$\frac{1}{2}$ cup	400

by the human body has not been demonstrated. It may be assumed that a diet which provides the known essential vitamins will furnish adequate amounts of those that are less well understood.

Vitamin E is a fat-soluble factor that appears to be involved primarily in muscle nutrition. Deficiency results in the accumulation of excess amounts of fluid in the connective tissues within the muscles, and in degeneration of muscle cells. This vitamin apparently is also essential in animal reproduction, particularly in the smaller animals, such as white rats, rabbits and guinea pigs. Its wide distribution in food makes deficiency unusual. It is not readily destroyed by heat. It is found chiefly in the germ of wheat and other seeds, in cottonseed oil, peanut butter, green vegetables, egg yolk, milk and meat. The daily requirement is not known.

Vitamin K is important to the body because it promotes the production of prothrombin which plays an essential role in the normal clotting of blood. Lack of this factor results in hemorrhages within the muscles and the abdominal cavity.

Food sources are cabbage, spinach and other green vegetables, cheese, egg yolk, tomatoes and liver. Deficiency is frequently encountered in newborn infants but seldom occurs in adults. Hemorrhages resulting from injuries received at birth may cause death during the first few days of life if the amount of prothrombin in the blood is low. To reduce the mortality from hemorrhage in newborn babies, the National Research Council recommends that vitamin K be administered to expectant mothers at least one month before the birth of the child.

The remaining vitamins that will be discussed here are members of the vitamin B group.

Biotin is a dietary essential, but its role in human nutrition is not completely understood. It is known that some of the bacteria which normally inhabit the human intestine produce this vitamin. Deficiency of this vitamin is not likely to occur.

Pantothenic acid is of importance in animal nutrition. It is believed to be needed by man but its role in human nutrition is still obscure.

Pyridoxine is needed for the proper utilization of proteins according to recent experimental work.

Choline is necessary in the metabolism of fatty acids.

Folic acid is of value in the treatment of pernicious anemia but it cannot entirely supplant the use of liver extract in the treatment of this disease since it does not prevent the degeneration of the spinal cord that frequently occurs. It is abundant in leafy vegetables and other vegetables, especially those that are green. Beef, veal, kidney and wheat are also good sources.

Inositol is an essential nutrient for animals but its function in human nutrition has not been determined.

Water. Water takes part in many of the chemical reactions constantly in progress in the body, serves as a vehicle for the transportation of food and waste products and assists in regulating body temperature. Water is being continuously lost from the body via the urine, feces and expired air. Water lost under ordinary circumstances, from an average sized individual, is about $2\frac{1}{2}$ qts. in twenty-four hours. This loss must be replenished to maintain the water balance of the body.

Aside from the water consumed as drinking water and in beverages, the body obtains considerable quantities of water from the food ingested. The body also obtains water from the process of oxidation since water is one of the end products of this process. Such water is called *metabolic water*. A person consuming 2400 calories of food daily derives about 300 cc. of water from this process.

The fluid balance of the body is usually taken care of by the normal mechanism of thirst. In some individuals this mechanism may be perverted so that the fluid intake may be either inadequate or excessive. Drinking a moderate amount of water with meals apparently improves the digestion and absorption of the food. It should not be used, however, to wash down poorly masticated food.

Roughage. Foods from the plant kingdom, as nature provides them, contain some indigestible material which consists chiefly of cellulose and is known as roughage. The shreds and fibers of fruits and vegetables and the bran of cereals belong to this category. Roughage, because of its bulk, serves the important function of mechanically stimulating the peristaltic intestinal movements, thus promoting normal evacuation of the bowels. A reasonable amount of roughage in the dietary is of value but an overabundance may be irritating to the intestinal tract.

NUTRITIONAL VALUE OF COMMON FOODS

The food components considered in the foregoing portion of this chapter constitute the basic requirements of the human body. They occur in varying amounts in the foods commonly consumed. To obtain an adequate diet it is necessary to choose foods that furnish sufficient quantities of carbohydrates, proteins, fats, minerals and vitamins. Most natural foods contain a variety of these nutrients but no one particular food can provide man satisfactorily with a proper balance of all of the nutrients he requires.

Fruits and Vegetables. Because they contain minerals and vitamins in abundance, and also because they supply bulk, fruits and vegetables are of outstanding value in human nutrition. They also lend attractiveness, variety and flavor to the diet.



Fig. 3. Vegetables and fruits contain valuable minerals vitamins and roughage.
(Courtesy of Good Health Magazine.)

Fruits are esteemed chiefly for their taste. Some contain fairly large quantities of carbohydrates, chiefly in the form of sugars, and hence have considerable energy value. The carbohydrate content of bananas, for example, is 22 per cent, while apples and oranges contain 14 and 11 per cent, respectively. Vitamins A, and B₁ and C are present in most of the fruits; peaches and apricots are especially rich in provitamin A while citrus fruits are particularly good sources of vitamin C. Some of the fruits, especially prunes, dates, figs, grapes and raisins, are good sources of iron.

Most fruits contain organic acids such as malic, citric or tartaric, which usually exist in combination with alkalis combined with salts of sodium, potassium, calcium or magnesium. In the body these compounds are converted into carbonates which are basic in reaction and help to maintain the alkaline reserves of the body.

Before eating fruits they should be washed to remove any traces of poisonous chemicals with which they were sprayed to protect them from insect pests. Thorough washing will also remove dirt and bacteria acquired in being handled by human beings.

Vegetables differ greatly in their carbohydrate content. Examples of some that are rich in carbohydrates are sweet potatoes (27 per cent), white potatoes (18 per cent), navy beans (19 per cent), corn (19 per cent), and dried peas (17 per cent). White potatoes provide not only starch but are especially valuable for their iron and vitamins B₁ and C. When cooked in their jackets, losses due to cooking are almost entirely avoided. The leafy vegetables are low in energy value but high in mineral and vitamin content. Green and yellow vegetables are good sources of provitamin A. Good vegetable sources of iron are beans, beet greens, chard, peas, spinach and potatoes. Raw cabbage, raw onions and tomatoes (raw or cooked) are particularly rich in vitamin C. Some vegetables such as beans, peas and lentils are fair sources of proteins. The proteins of soy beans are of high quality. Green soy beans provide most of the body's needs. Dried soy beans lack vitamin C.

Grain Products. These comprise the cereals: wheat, rye, barley, rice, oats and their products such as breadstuffs and breakfast foods. Wheat is the most valuable of all grains, composing a large part of the dietary of mankind throughout the world. The cereal grains are energy foods due to the starch they contain but are valuable also for their mineral and vitamin content, if used in the unmilled state. The average American obtains about one fourth of his daily caloric requirements from grain products. Whole grain cereals are particularly good sources of thiamine and other members of the B group of vitamins.

Many of the valuable elements of cereals are lost in the process of milling. Ordinary white flour is made from wheat from which the germ (embryo) and the outercoats (bran) have been removed. These discarded parts contain most of the vitamins and minerals of the wheat kernel. Such flour is largely devoid of thiamine, riboflavin and niacin and other B complex vitamins, and contains only one fifth as much iron as whole wheat flour. This is a serious loss since flour bulks large in the dietary of our people, contributing about 25 per cent of the calories of the average diet.

In many states it is now required by law that all white flour used by commercial bakers in the baking of bread and rolls, as well as the white flour sold to householders, be enriched. The enrichment is designed to restore to the flour the three important B vitamins—thiamine, riboflavin and niacin—as well as iron, which are almost completely removed in the

milling process, in order to make it more closely equivalent to whole wheat flour in regard to these nutrients.

Milk and Milk Products. Milk is unique among foods in that it meets the nutritional needs of the body better than any other single food with the possible exception of the soy bean. It contains superior proteins (chiefly casein and lactalbumin), energy-supplying fat and carbohydrate (lactose), and an abundance of minerals and vitamins. It is an unsurpassed source of calcium but is low in iron. A quart of milk per day provides all of the calcium and most of the phosphorus required by the body.

Milk is an excellent source of vitamin A, an important source of riboflavin and niacin, a good source of vitamin E, a fair source of thiamine and ascorbic acid, and provides some vitamin D.

A quart of milk provides 32 gm. of protein, or more than one third of the daily requirement. The fat in milk is in a finely divided form (emulsion), which facilitates its digestion. The average composition of cow's milk is as follows:

Water	87 per cent	Milk sugar	5 per cent
Protein	3.3 per cent	Minerals	0.7 per cent
Fat	4 per cent		

Because it is digested slowly, milk sugar (lactose) remains in the intestinal tract for a longer period than do other sugars. This is a distinct advantage because it provides food for a desirable group of bacteria (lactic acid bacteria) which are capable of fermenting lactose, converting it into lactic acid. The lactic acid thus produced checks the growth of troublesome bacteria capable of giving rise to toxic decomposition products in their action on proteins.

When milk is pasteurized, about 30 per cent of its vitamin C content is destroyed. Pasteurized milk is milk that has been heated to a temperature of about 145° F. and kept at that temperature for thirty minutes. Pasteurization is a factor of safety since it destroys disease-producing bacteria that may have entered the milk. In the home milk should be kept cold, since at room temperature a rapid multiplication of bacteria occurs.

Homogenized milk is milk that has been treated to break the fat globules into particles so small that they remain evenly distributed throughout the milk and do not rise to form cream. It is of uniform consistency, i.e., homogeneous throughout. Homogenization is carried out by forcing the milk through very narrow openings at a speed of nearly a mile a second against a smooth surface. This causes the fat globules to become shattered into exceedingly minute globules. In the stomach such milk forms a soft

curd which is more quickly digested than a hard curd. When fortified with vitamin D a thorough distribution of this vitamin results since it is associated with the fat in the milk.

Butter is made from the fat of milk and has high caloric value. It is one of the richest sources of vitamin A. Cheese is a concentrated food consist-

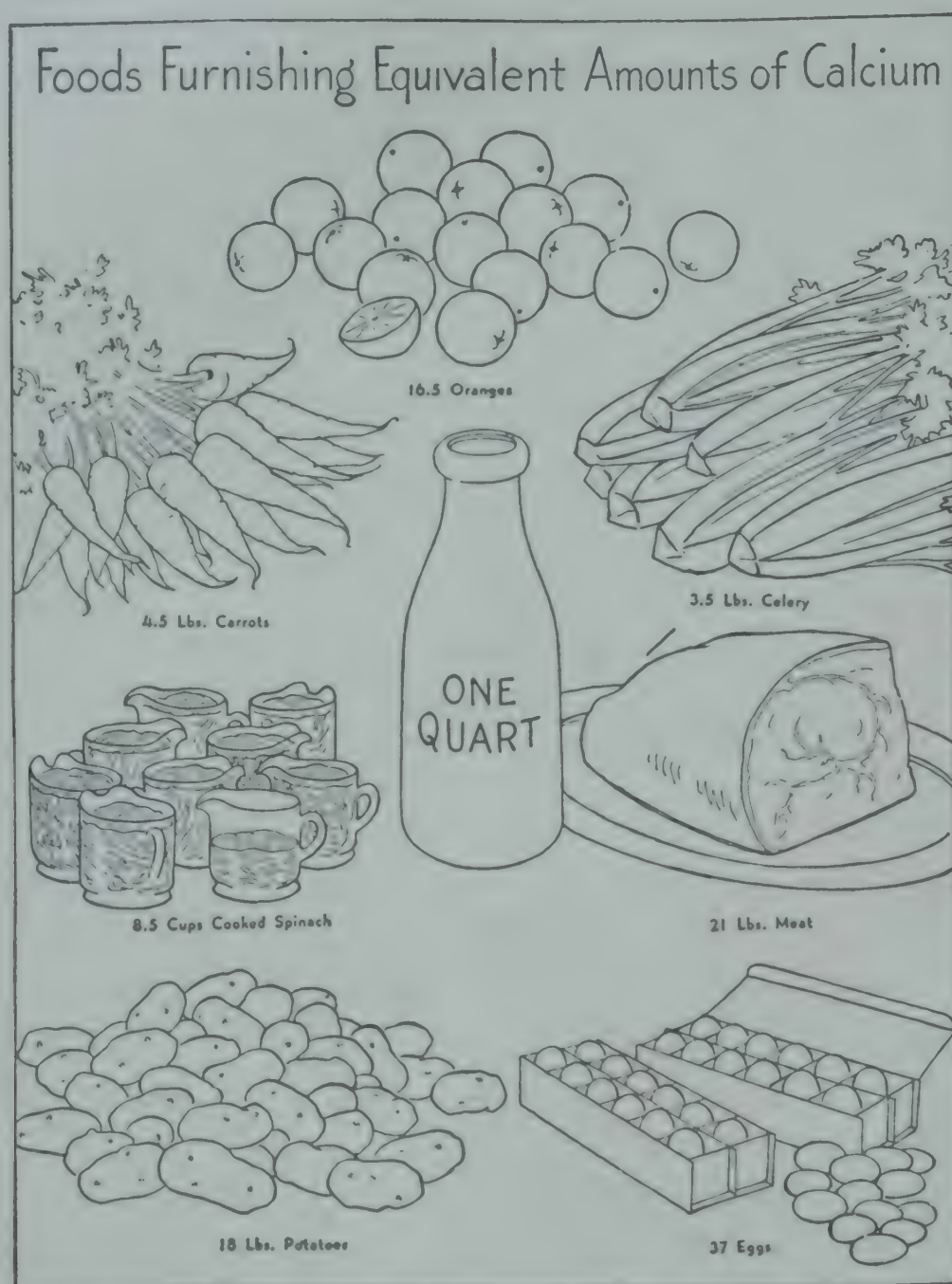


Fig. 4. Foods furnishing equivalent amounts of calcium. (Courtesy of National Dairy Council.)

ing chiefly of the solid part of milk. American cheddar cheese contains about 35 per cent fat, 25 per cent protein, and is rich in mineral matter. A generous daily quota of milk and milk products contributes much toward a well-balanced dietary.

Eggs. Eggs are good sources of fat, proteins, minerals and vitamins but are practically devoid of carbohydrates. The average composition of hens' eggs may be stated as follows:

Water	74.0 per cent	Carbohydrate	0.7 per cent
Protein	12.8 per cent	Mineral	1.0 per cent
Fat	11.5 per cent		

Egg white consists chiefly of water and protein. The yolk contains fat, proteins, minerals and vitamins A, B₁, D and riboflavin. Nutritionists advise the eating of at least four eggs (or egg yolks) each week.

Meat, Fish and Poultry. The meat foods are important sources of proteins and usually provide fat also. Meats are good sources of iron and phosphorus as well as of thiamine and riboflavin. Pork is particularly high in thiamine. Liver is a good source of iron, vitamin A, thiamine, riboflavin, and contains some vitamin D. The glandular organs, such as liver, sweetbreads and kidneys, contain more iron than does muscle meat. Sea fish, oysters and clams are good sources of iodine.

Nuts. Nuts vary considerably in composition but in general they are rich in protein, fat and carbohydrate. Some nut proteins are of high quality. Most varieties of nuts are good sources of thiamine and riboflavin. Peanut butter contains approximately 29 per cent protein, 46 per cent fat and 17 per cent carbohydrate.

Sugar. Table sugar is practically chemically pure sucrose. It supplies only one nutrient, being devoid of minerals, vitamins and other food factors. Its only importance as a food is its fuel value, which can be readily replaced by many other foods that provide minerals and vitamins in addition to calories. It is not an essential food. The per capita annual consumption of sugar in the United States is over one hundred pounds. The sales of candy manufacturers amount to more than a billion dollars annually.

It has been well established that a high consumption of sweets is accompanied by a high rate of tooth decay. It also leads to overeating and overweight, and increases the probability of diabetes and other degenerative diseases. It would be a step forward if the amount of land and labor used in the production of sugar were materially decreased and the production of foods which provide more than mere fuel increased.

QUESTIONS FOR CLASS DISCUSSION

1. Distinguish between "hollow hunger" and "hidden hunger."
2. Why is the nutrition of our people of national importance?
3. Formulate a definition for the term "food."
4. What are carbohydrates? How may they be classified? Give examples of each class.
5. What use does the body make of carbohydrates?
6. How much of its energy does the body usually obtain from carbohydrates?
7. What are the end products of carbohydrate oxidation?

8. What are fats? What purpose do they serve?
9. Give examples of foods that are good sources of fats.
10. How much of its energy does the body usually obtain from fats?
11. What are proteins? Of which simpler compounds are they composed?
12. Differentiate between "complete" and "incomplete" proteins.
13. What are "nutritionally indispensable" amino acids?
14. What purposes do proteins serve in the body?
15. Which minerals need special consideration because they are frequently deficient in the dietary?
16. Of what particular importance in the body are (1) calcium, (2) phosphorus, (3) iron and (4) iodine? Give the daily requirements and good sources of these minerals.
17. Explain the geographic distribution of simple goiter in the United States.
18. What are vitamins?
19. How do processed and refined foods compare with natural foods in vitamin content?
20. Is there any similarity in action between some vitamins and enzymes?
21. Distinguish between vitamin A and provitamin A.
22. Discuss vitamin A with reference to (1) its action in the body, (2) results of an inadequate supply, (3) daily requirement, (4) sources.
23. What is the chemical name of vitamin B₁?
24. Answer question 22 as it applies to thiamine, riboflavin, and niacin.
25. Can the requirement for thiamine be easily met? Which type of food in particular should be included in the diet to be sure of an adequate amount?
26. Name other members of the vitamin B complex.
27. What is the chemical name of vitamin C?
28. Explain the following points in regard to ascorbic acid and vitamin D: (1) action in the body, (2) results of an inadequate supply, (3) daily requirements, (4) sources.
29. What is the relationship between certain sterols and vitamin D?
30. What is viosterol?
31. Give the important points about vitamins E and K.
32. How can one make sure that one will get all of the vitamins in adequate amounts?
33. What are the chief functions of water in the body? How much is necessary and what conditions modify the amount needed?
34. What is roughage? Of what value is it in the dietary?
35. What are the chief dietary constituents of (1) fruits, (2) vegetables, (3) bread, (4) milk, (5) cheese, (6) eggs, (7) meat and (8) nuts?
36. Why is milk particularly valuable as a food? Why should it be pasteurized?
37. What is homogenized milk?
38. Discuss "table sugar" as a human food. Is it advisable to include candy in the dietary? Explain.

TOPICS FOR ORAL OR WRITTEN REPORTS

1. Make a study of the early work that led to the discovery of the vitamins.
2. Study the diet of a diabetic patient. How does it differ from a normal diet? Why is insulin of value in this disease?
3. Discuss the nature and cause of appendicitis.

See Chapter 3 for bibliography.

CHAPTER 3

Hygienic Aspects of Nutrition



A PROPERLY chosen diet must provide a total quantity of food adequate to the particular needs of the individual and in addition it must contain all of the nutritional factors, such as the essential amino acids, various inorganic salts and a full assortment of the vitamins, required by the body to regulate its activities and to assemble and synthesize its essential components. Such a dietary provides the energy needs as well as all of the other nutritional needs of the body. In other words, it is quantitatively and qualitatively adequate to meet the nutritional needs of the body.

ENERGY VALUE OF FOOD

The energy needed by the body for its activities and the maintenance of body heat is derived from the food it consumes. By the process of oxidation the body is able to obtain energy from food, very much as an engine gets energy by burning fuel; the body, however, is not a heat engine. The human body requires forms of energy other than heat. In a heat engine, heat is the source of its activity but in the body heat is the result of activity. The potential energy of food, however, is most conveniently expressed in terms of heat energy. The energy value of a food can be measured in terms of the heat it yields when burned, and is represented by the heat unit known as a *calorie*. By definition a food calorie is the amount of heat required to raise the temperature of 1 kilogram (1000 grams) of water 1 degree C. This is sometimes called the large calorie or kilocalorie to distinguish it from the small calorie (used in physics and chemistry), which is the amount of heat required to raise the temperature of 1 gram of water 1 degree C. The kilocalorie is the standard heat unit used in the science of nutrition. The term calorie is used not only to represent the energy value of food but also to represent the energy expenditure of the body.

The apparatus used in determining the energy value of food is known as a *bomb calorimeter*. In it a weighed quantity of food is burned in an atmosphere of pure oxygen in a chamber surrounded by a known weight of water. The heat liberated is absorbed by the water and the rise in the

temperature of the water indicates the amount of heat produced. It has been found that the physiologic fuel value of the three kinds of food components that are oxidized in the body is as follows:

1 gram of carbohydrate	= 4 calories
1 gram of fat	= 9 calories
1 gram of protein	= 4 calories

In order to maintain the normal energy level of the body the food intake must have a fuel value equal to the energy requirements of the body.

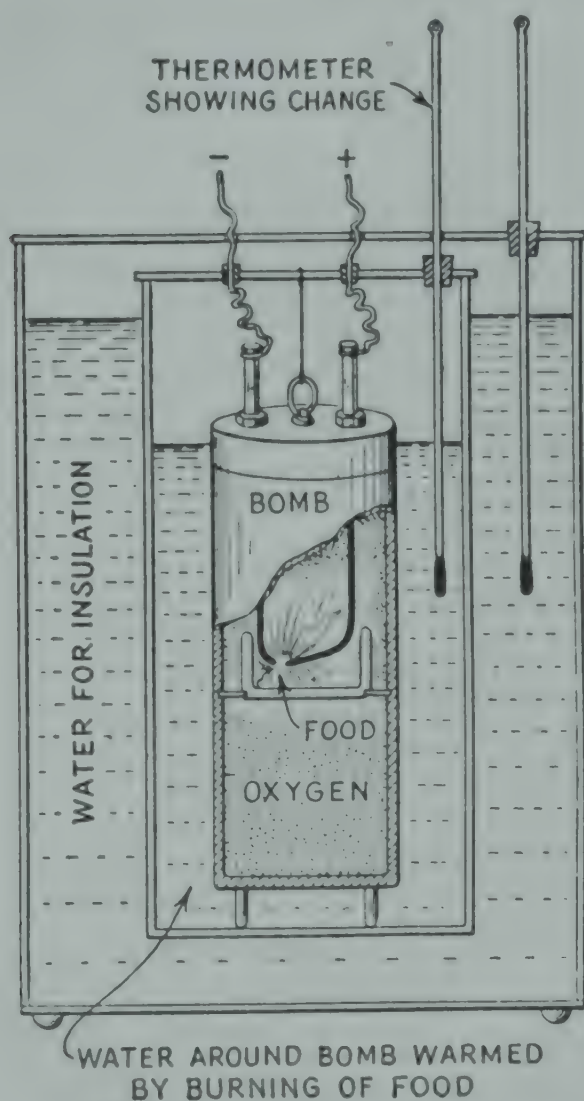


Fig. 5. Bomb calorimeter. (From Hunter, Life Science. Courtesy of American Book Co.)

ENERGY NEEDS OF THE BODY

The quantity of fuel required varies with different individuals and depends largely upon age, surface area of the body, activity, and temperature of the environment. To determine human fuel requirements it is necessary first to ascertain the rate of energy expenditure of the body at rest (basal metabolism) and then add the extra calories needed for the day's activities. Basal metabolism represents the minimum energy expended by the body, i.e., the energy needed to maintain body temperature,

circulation, respiration, glandular activity, peristalsis and muscle tone, under conditions of rest in bed fifteen to sixteen hours after food has been taken. Under these conditions, when the body is at its lowest ebb of

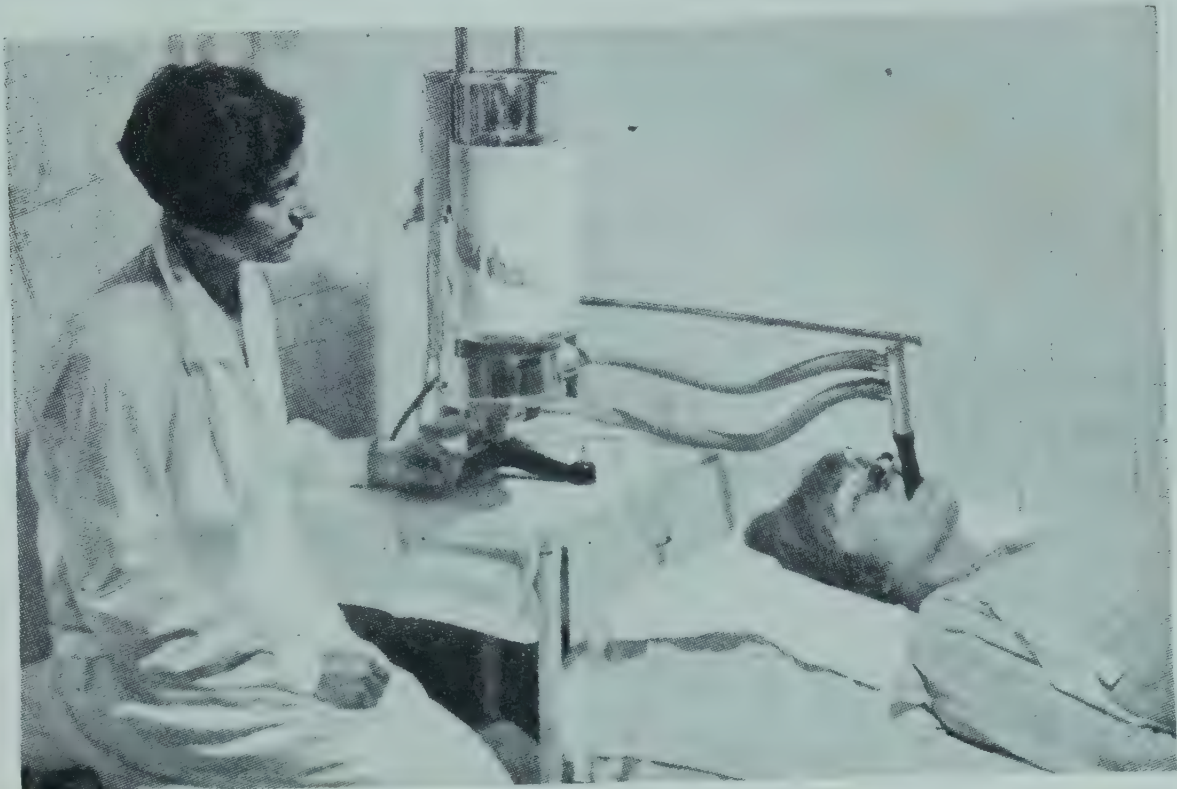


Fig. 6. Basal metabolism test. (Courtesy American Druggist.)

activity, the average young woman requires about 58 calories per hour or 1400 calories for a twenty-four hour period, while an average young

TABLE 9
DAILY CALORIC ALLOWANCES*

INDIVIDUAL	CALORIES	INDIVIDUAL	CALORIES
Man (154 lb., 70 kg.)		Children up to 12 years	
Sedentary	2400	Under 1 year	110 per kg.
Physically active	3000	1-3 years	1200
With heavy work	4500	4-6 years	1600
		7-9 years	2000
Woman (123 lb., 56 kg.)		10-12 years	2500
Sedentary	2000	Children over 12 years	
Moderately active	2400	Girls, 13-15 years	2600
Very active	3000	Girls, 16-20 years	2400
		Boys, 13-15 years	3200
		Boys, 16-20 years	3800

* Adapted from National Research Council, Reprint and Circular Series No. 129. Recommended Dietary Allowances, October, 1948.

man needs about 70 calories per hour or 1680 in twenty-four hours. Any increase in body activity raises the energy requirement. Mental work

causes only a slight increase in the energy needs of the body. The total food intake must provide the calories needed for basal metabolism plus additional calories to cover the energy requirements for the day's activities.

Table 9 indicates the daily caloric needs of men, women and children. These caloric allowances represent group averages and must be adjusted up or down to meet the needs of the individual. A caloric intake which maintains body weight or rate of growth at a level conducive to well-being is usually a satisfactory one.

There are two methods of determining basal metabolism. One method involves placing the individual in a chamber known as a respiration calorimeter and making a direct measurement of the heat given off by the body. The other is an indirect method and is the one most commonly used. It involves the use of the Benedict Roth calorimeter. The rate of metabolism is calculated from the amount of oxygen consumed. The calculations are based on the fact that every cubic centimeter of oxygen consumed results in the production of 0.0048 of a calorie of energy. An individual, for example, who consumes 245 cc. of oxygen a minute expends 245×0.0048 or 1.17 calories of energy per minute, which is equal to 1.17×60 or 70.2 calories per hour.

SELECTING A BALANCED DIETARY

The caloric value of a diet is but one measure of its nutritional adequacy. Although the greatest quantitative need is for calories, it is necessary to obtain, along with the calories, the requisite amounts of other dietary essentials. A health-maintaining diet includes, in ample amounts, all of the nutritive factors needed by the body. Although proteins supply some energy, the carbohydrates and fats serve as the primary source of body energy. These foods, therefore, must be chosen in quantities sufficient to fulfill the energy requirements of the body. From the data recorded in Table 10 (at end of chapter) the student may ascertain the caloric value of average servings of foods commonly used.

Proteins are needed chiefly to provide the necessary amino acids. An adult of average weight requires between 60 and 70 gm. The daily mineral intake should include at least 1 gm. of calcium, 1.5 gm. of phosphorus, 12 mg. of iron and 0.15 to 0.30 mg. of iodine. The various vitamins must be included in adequate amounts.

It is particularly important to give thought to the mineral and vitamin needs of the body because dietary deficiencies occur most frequently in these nutritional factors. Calcium and iron are the minerals most commonly deficient. A generous allowance of milk, cheese, vegetables and fruits will assure adequate calcium, while iron is provided by eggs, meat, leafy vegetables and fruits.

The so-called "protective foods" (green leafy and yellow vegetables, fruits and milk) make a good starting point in balancing the daily menu. If these are chosen in adequate amounts to serve as the foundation of the dietary, the mineral and vitamin needs will be taken care of. The remainder of the diet may be selected from cereals, whole wheat or enriched bread, eggs, meat and additional vegetables to satisfy the desires of the individual.

It is difficult to be properly nourished without eating a good breakfast. It has been found that many people, especially young women, omit breakfast from their menu. Research work conducted with a group of young women clearly indicates that a good breakfast increases work output and mental alertness, and delays muscular fatigue during the morning hours. It is advisable that the morning meal provide from one quarter to one third of the daily food intake.

BASIC FOODS FOR HEALTH

Optimum nutrition requires that the following foods, in the approximate amounts indicated, be included in the daily dietary. By following this scheme the individual translates food knowledge into practice.

Milk: a pint a day for adults, a quart for children.

Butter: two or more tablespoonfuls. If butter is not available oleomargarine fortified with vitamin A may be substituted.

Vegetables: potatoes and two liberal servings of other vegetables, one of which should be green or yellow.

Fruits: two servings of fruit, preferably raw, one of which should be a good source of vitamin C, such as a citrus fruit (orange or grapefruit) or tomato.

Cereal and Bread: some at each meal, natural whole grain or enriched.

Eggs: four or five a week or one a day if preferred.

Meat, Fish or Fowl: a moderate quantity at two or three meals a week or once a day. If difficult to obtain, cheese, dried beans, peas, nuts or peanut butter may be substituted.

Since the need for vitamin D cannot be met by food alone, it is advisable to complement the dietary with fish liver oils daily during the colder portion of the year (October to May). This is particularly important for children and pregnant and lactating women in the temperate zone.

DIETARY ACCESSORIES

Civilized man makes use of flavors and condiments to season his viands and thus add to their savoriness. Spices and flavors stimulate the appetite

and the flow of digestive juices. Certain condiments, however, such as pepper, mustard, ginger, cloves, allspice and vinegar may irritate the stomach and thus do harm, if used too freely. It is advisable to cultivate a taste for food in its natural state and to use spices sparingly.

Stimulating beverages such as coffee and tea are used extensively in the American dietary. Coffee contains (1) an alkaloid known as caffeine, which is a stimulant to the nervous system, and (2) a small amount of tannic acid which is an astringent. Coffee has the effect of a hot drink, a fine aroma and that of caffeine which stimulates the nerve centers and accelerates circulation by slightly increasing the force of the heart's action. Caffeine increases mental activity in conditions of mental fatigue. Tea also contains caffeine and tannic acid. A cup of tea usually contains less caffeine but more tannic acid than does a cup of coffee. Tea which has been steeped for a long time contains a considerable quantity of tannic acid and may have a tendency to cause constipation in some people. The drinking of large quantities of coffee or tea may give rise to a condition known as caffeinism which is characterized by paleness, restlessness, insomnia, and in some cases other symptoms.

There is no conclusive scientific evidence that coffee or tea, when used in moderation, are harmful except to those individuals whose nervous systems are particularly sensitive to the stimulants in these beverages. For children it is generally agreed that coffee and tea are harmful because they tend to produce instability of the nervous system and displace milk in the diet.

FACTORS AFFECTING DIGESTION

The selection of food on a scientific basis does not preclude attention to the psychic factors which may affect its digestion. In human beings the digestive process may be largely dependent upon the state of mind. Mental attitudes exert profound effects upon the digestion of food; they may make or ruin good digestion.

Mealtime should be a pleasant occasion in attractive surroundings with congenial associates. Food that is palatable and served attractively favors good digestion. A cheerful emotional atmosphere is also conducive to good digestion while unpleasant emotions such as fear, anxiety and anger disturb the digestive process. Fatigue and depressing emotional states retard gastric and intestinal secretions as well as the normal peristaltic movements of the entire digestive tract. When one is mentally upset it is inadvisable to eat.

Ample time should be allowed for each meal. Thorough mastication

is necessary for good digestion; it grinds the food into very small particles which enables it to be digested more readily and also stimulates a greater flow of digestive juices.

NUTRITIONAL DISORDERS

Digestive disturbances are the common lot of mankind. In many cases they are due to lack of understanding of man's food problems, unwillingness to correct faulty food habits or to select a health-maintenance diet.

Indigestion. The term "indigestion" refers to a train of symptoms resulting when the digestive tract is not functioning properly. The symptoms may be misleading for the cause of the disturbance may not necessarily lie in the stomach or intestine but may be due to an infected gall-bladder, a diseased appendix, or to a state of anxiety. Sometimes it is due to improper food, food idiosyncrasies on the part of the individual, food-poisoning, overeating or constipation.

Persons who frequently experience digestive disturbances often become easy prey to commercial exploitation. Many antacid drugs are advertised to the public for use in gastric discomfort. As a result, the belief has been fostered in the minds of the public that stomach distress is due to excess acidity. Antacids frequently give temporary relief from stomach discomfort regardless of whether the acidity of the stomach is high, normal or low. They relieve stomach symptoms but do not correct the underlying conditions responsible for the symptoms. The indiscriminate use of alkaline chemicals may seriously disturb the acid-base balance of the body and lead to a condition known as "alkalosis."

Constipation. Constipation is a common disorder brought about by various causes, such as: (1) dietetic deficiencies (lack of roughage or thiamine), (2) neglect of the normal impulse to empty the bowel, (3) emotional stress, (4) too little muscular activity, (5) ulcer, (6) gall-bladder disease, (7) cancer, and a number of other factors. The first three factors listed above appear to be responsible for the majority of cases. There are two types of constipation, *atonic* and *spastic*. Atonic constipation is a condition in which the bowel has lost its tone and much of its contracting power and, therefore, is sluggish and distended. In spastic constipation, which is the more common form, strong muscular contractions, steadily maintained, occur in localized areas of the intestine. Such muscle spasms temporarily halt the normal wavelike contractions (peristalsis) of the intestines. Eventually the muscles relax followed by spasms in another area. The use of harsh cathartics may aggravate this condition.

There are certain factors that help to keep the bowels normally active,

namely, proper food, a sufficient fluid intake, freedom from emotional stress, regular physical exercise and correct posture. Certain foods have laxative effects. Those that contain roughage, such as many vegetables, fruits and whole grain cereals, are of value. An ample supply of thiamine in the diet helps to keep the bowels in normal condition. In spastic constipation roughage in concentrated form, such as bran, may do harm by irritating the delicate mucous membrane lining the intestinal tract. Bran has the tendency to produce a dry irritating bowel movement. Fruits and vegetables are preferable to bran, for the roughage they contain is less irritating.

The widespread prevalence of constipation has led to the use of drugs for its relief. The nation-wide advertising of these preparations has made the public "constipation conscious." The national cathartic bill is about fifty million dollars annually. Cathartic drugs should be avoided or used only when prescribed by a physician. The habitual use of cathartics is harmful. The body becomes dependent upon them to the extent that bowel movement without the use of drugs becomes difficult. Most laxative drugs are definitely harmful in continued doses. Mineral oil, which is widely used, has been shown to interfere with the absorption of vitamin A, carotene, vitamin D, calcium, phosphorus and vitamin K. These food substances are absorbed by the mineral oil and are eliminated unused with the oil.

Pain in the abdominal region may be caused by an inflamed appendix. Under such conditions the use of cathartics may cause the appendix to rupture and endanger the life of the individual.

Nutritional Anemia. Anemia resulting from insufficiency of iron in the diet is not uncommon. Being of dietary origin, this type of anemia occurs when food does not contain enough assimilable iron for the formation of the normal amount of hemoglobin of which iron is an essential constituent. In this condition the oxygen-carrying capacity of the blood is impaired. Nutritional anemia is more common in women than in men. The condition can be avoided by including in the diet ample quantities of green leafy vegetables, fruits, whole grain cereals and red meats.

Not all iron deficiency anemias are nutritional. Some cases are due to chronic infection and other causes.

Food Allergy. Allergy is a condition in which the body is hypersensitive to a certain substance introduced into it or coming in contact with it. The body reacts in an abnormal manner to these substances, which collectively are called allergens. Foods, condiments and beverages may

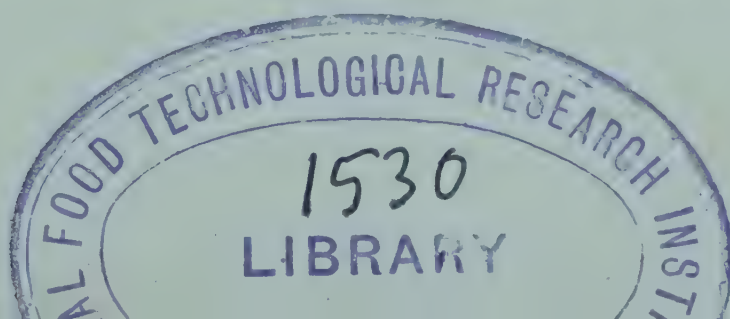
serve as allergens and give rise to various types of allergic manifestations in certain individuals. The commonest types of food allergy are asthma, urticaria (hives), migraine, rhinitis (symptoms resembling the common cold), nausea, vomiting and diarrhea. In some individuals two or more of these may exist at the same time and may be caused by the same or by different allergens. Occasionally hay fever is due to a food allergen. There appears to be a hereditary tendency to the development of allergy since allergic individuals are found more commonly in some families than in others.

If the cause of a food allergy is known, the food can be avoided or the individual may be desensitized to it. Desensitization is accomplished by injecting the body with the offending allergen. The first injections consist of very small amounts. The dose is gradually increased until the allergen is tolerated.

Food Poisoning. Food poisoning may be caused by foods that are naturally poisonous, such as certain mushrooms, by foods into which chemical poisons have been accidentally introduced or by foods containing toxins due to the presence of certain bacteria. This latter type of food poisoning is frequently encountered. Such food poisoning formerly was called "ptomaine poisoning" because it was believed to be due to decomposition products called ptomaines. It is now known that bacterial food poisoning is due not to ptomaines but to specific toxic substances elaborated by bacteria.

A common form of food poisoning is caused by Staphylococcus aureus. Outbreaks are due usually to food handlers who have skin sores infected by these bacteria. When staphylococci are introduced into certain foods they grow very rapidly unless the food is refrigerated. As they grow and multiply they give rise to a toxin (enterotoxin) which is highly irritating to the intestinal tract. The toxin is very resistant to heat, being able to withstand the boiling temperature. Foods commonly associated with this type of poisoning are custard-filled bakery products such as eclairs, filled cakes and custard pies as well as ground meats, ham and salads. Symptoms of poisoning develop within two to four hours after partaking of such food. The symptoms include weakness, abdominal pain, nausea, vomiting, diarrhea and cramps. Recovery is usually rapid.

Another type of food poisoning is caused by certain species of bacteria that belong to the group known as *Salmonella*. These organisms produce a heat-resistant toxin when they grow in meat, milk products, fish, eggs, poultry and other foods. The symptoms of *Salmonella* food poisoning



are due not only to toxins present in the food but also to the intestinal infection which quickly follows the eating of food contaminated with these organisms. The symptoms develop within four to twenty-four hours and include severe gastrointestinal discomfort with marked prostration. Recovery occurs within one to seven days.

The most dangerous type of food poisoning is *botulism* caused by a bacterial species called *Clostridium botulinum*. Most cases of botulism result from the consumption of canned vegetables, especially those canned in the home. The bacteria in the spore stage are highly resistant to heat and may not be destroyed in the canning process if inadequately heated. The spores will later germinate into active cells and produce a highly potent toxin. This toxin can be destroyed by heat but if foods containing botulinum toxin are eaten without being thoroughly heated the toxin is ingested and botulism results. Such foods frequently show very little indication of spoilage. Any food showing the slightest sign of spoilage should be discarded without even being tasted. Merely tasting the food and spitting it out may introduce enough toxin into the body to prove fatal. Foods commonly involved are home-canned string beans, corn, spinach, asparagus, beets and certain meat products. Canned fruits, due to their acid reaction, are rarely dangerous.

The scientific canning procedures now used in commercial canning establishments have practically eliminated the occurrence of botulism due to the consumption of their products. In the home, however, the principles developed by the canning industry are not always applied. Without the use of a pressure cooker, certain foods such as nonacid vegetables (string beans, corn, peas, etc.) cannot be properly processed, since a temperature above the boiling point is necessary to preserve these foods safely. Most cases of botulism occurring in the United States are caused by home canned string beans, with home canned sweet corn holding second place. Raw vegetables fresh from the garden cannot cause botulism. The bacteria grow only in vegetables that have been cooked and require the exclusion of air for growth.

The symptoms of botulism are due chiefly to the action of the toxin on the nervous system, the toxin being neurotoxic. The first manifestations are usually weakness and uncertainty in walking, fatigue, dizziness and a visual disturbance causing blurred and double vision. These are followed by dryness of the throat, difficulty in swallowing, impairment of speech and drooping of the eyelids. The patient rarely has any pain. Death may ensue after three to seven days and is usually due to respiratory paralysis. The mortality is usually 50 per cent or higher.

TABLE 10

CALORIC VALUE OF AVERAGE SERVINGS OF COMMON FOODS

<i>Food</i>	<i>Amount</i>	<i>Calories</i>
Almonds	15 nuts	100
Apple	1 small	65
Apple sauce, sweetened	$\frac{1}{2}$ cup	80
Bacon	5 small pieces	100
Banana	1 medium	100
Beans, lima, canned	$\frac{1}{2}$ cup	70
Navy, baked	$\frac{1}{2}$ cup	115
Snap, canned	$\frac{1}{2}$ cup	19
Beef, hamburger	1 small (7 per lb.)	145
Lean	3" x 3" x $1\frac{3}{4}$ " (3 oz.)	135
Steak	1 small serving	200
Beer	1 bottle (12 oz.)	145
Beets, canned	$\frac{1}{2}$ cup	40
Beverages, carbonated	1 bottle (6 oz.)	82
Brazil nuts	2	100
Bread, white or whole wheat	1 average slice	65
Breakfast cereals	1 average serving	100
Butter	1 tbsp.	100
Cabbage, raw	$\frac{3}{4}$ cup	15
Cooked	$\frac{1}{2}$ cup	30
Cake, chocolate, layer, iced	1 medium piece	360
Cup, iced	1	240
Plain, layer, iced	1 medium piece	300
Sponge	1 medium piece	150
Cantaloupe	$\frac{1}{2}$ small	25
Carrots, cooked	$\frac{2}{3}$ cup	30
Cashew nuts	9 medium	100
Celery	2 stalks	10
Cheese, American or Swiss	$1\frac{1}{4}$ " cube	130
Cottage	5 tbsp.	100
Chicken, roasted	4" x 2" x $\frac{1}{4}$ "	50
Chocolate fudge	1" cube	100
Cookies, chocolate	2 $\frac{1}{4}$ " diameter	35
Oatmeal	3" diameter	124
Sugar	2 $\frac{1}{4}$ " diameter	30
Corn syrup	2 tbsp.	100
Corn, canned	$\frac{1}{2}$ cup	100
Cornstarch pudding	$\frac{1}{2}$ cup	180
Custard, baked	$\frac{1}{2}$ cup	200
Crackers, graham	1	40
Soda	1	25
Cream, thin	1 tbsp.	30
Heavy	1 tbsp.	60
Heavy, whipped	1 $\frac{3}{4}$ tbsp.	60
Dates	4	100
Eclair, chocolate icing	1 avg.	250
Egg, whole	1 medium	75
Yolk	1 yolk	60
Figs	3 medium	90

TABLE 10

CALORIC VALUE OF AVERAGE SERVINGS OF COMMON FOODS
(Continued)

<i>Food</i>	<i>Amount</i>	<i>Calories</i>
Filberts	12 nuts	100
Fish, fried	3" x 4" x 1"	200
Steamed	3" x 4" x 1"	100
Frankfurter	1 sausage, medium	100
French dressing	1 tbsp.	65
Gelatin, lemon	1½ cup	75
Grapefruit	½ medium	50
Gravy	1 tbsp.	15
Griddle cakes	3½" diameter	65
Ham, boiled	4" x 4½" x 1⅛" (1½ oz.)	150
Honey	2 tbsp.	100
Ice cream	¾ cup	225
Soda	Fountain serving	270
Sundae	Fountain serving	375
Lamb, leg, roasted	3" x 4" x 1¼"	200
Lettuce	3 large leaves	10
Liver, beef, fried	3" x 4" x 1½"	160
Mayonnaise	1 tbsp.	100
Meat loaf	4" x 6" x 1⅛"	100
Milk, whole	1 large glass (8 oz.)	165
Butter milk	1 large glass (8 oz.)	85
Malted	Fountain serving	500
Orange	1 medium	75
Peach	1 medium	50
Peanut butter	1 tbsp.	95
Peanuts, roasted	17 nuts	85
Pear	1 medium	70
Peas, canned	½ cup	70
Pecans	10 halves	100
Peppers, green	1 medium	30
Pie, apple	⅙ of medium pie	265
Pumpkin	⅙ of medium pie	329
Pineapple juice	½ cup	55
Pork roast, lean	3" x 3½" x 1¼"	85
Chop, lean	1 medium	250
Potato, white	1 medium	100
Sweet	½ large	125
Prunes	5 cooked	150
Rice pudding	½ cup	260
Salmon, canned	½ cup	100
Sandwich, cheese and jelly	1	290
Ham	1	200
Sardines	4	100
Sherbet, milk, lemon	⅝ cup	250
Shrimp, canned	½ cup	65
Soup, cream of tomato	⅔ cup	160
Vegetable	⅔ cup	45
Spinach, cooked	½ cup	25

TABLE 10

CALORIC VALUE OF AVERAGE SERVINGS OF COMMON FOODS
(Concluded)

<i>Food</i>	<i>Amount</i>	<i>Calories</i>
Squash	1½ cup	45
Sugar	1 tsp.	20
Tapioca pudding	1½ cup	140
Tomato juice	1½ cup	25
Tuna fish, canned	1½ cup	130
Turnips	1½ cup	35
Veal cutlet	1 medium	145
Roast	3" x 3¾" x 1¼"	100
Walnuts, English	10 halves	100
Waffle	6" diameter	225
Wheat germ	1 tbsp.	40

HEALTH PRACTICES TO BE ACQUIRED

The information given in this and the preceding chapter suggests the desirability of establishing health practices in regard to the proper nutrition of the body. The following health practices should be acquired:

1. Include ample amounts of the protective foods (leafy vegetables, fruits and milk) in the dietary.
2. Select sufficient quantities of carbohydrates, fats and proteins.
3. Eat slowly and under conditions that are conducive to a serene mental attitude.
4. Enjoy the food you eat, but do not permit personal food habits to undermine your health.
5. Allow for an adequate, fluid intake.
6. Establish the habit of regular bowel movements and avoid the use of cathartic drugs.

QUESTIONS FOR CLASS DISCUSSION

1. By what process does the body obtain energy from food?
2. Name and define the unit that is used to indicate the energy value of food.
3. How is the caloric value of food determined?
4. How many calories does a gram of carbohydrate yield? A gram of protein? A gram of fat?
5. What are the factors that determine the quantity of fuel foods required by the body?
6. Explain basal metabolism. How is it measured?
7. What are the important factors in the selection of a well balanced dietary?
8. Discuss carbohydrates, fats and proteins from the point of view of a balanced dietary.
9. Which foods are needed to maintain (1) the mineral balance, (2) the vitamin balance of the body?

10. Name the basic foods and approximate amounts that need to be included in the daily dietary.

11. What are "protective" foods? Why are they so called?

12. Why is it advisable to supplement the diet with fish liver oil during the winter months?

13. Summarize the important points that must be taken into consideration in properly balancing the dietary.

14. Have you taken steps to balance your own dietary adequately?

15. Plan a dietary for a week that would adequately meet your physiologic needs.

16. Of what value are flavors and condiments?

17. Discuss the use of coffee and tea in the dietary.

18. What effect has the emotional state of the individual on the efficiency of digestion? How does fatigue affect digestion?

19. Why is thorough mastication necessary for good digestion?

20. What are some of the causes of indigestion?

21. Outline a mode of living that should prevent constipation.

22. What dangers are associated with the use of cathartic drugs?

23. Discuss food poisoning caused by the toxins of bacteria.

24. Summarize the health practices one should acquire in regard to nutrition.

TOPICS FOR ORAL OR WRITTEN REPORTS

1. Investigate the subjects of (1) tapeworms and (2) trichina worms.

2. Investigate the regulations of your community that pertain to the washing and sterilizing of soiled dishes and cutlery in public eating establishments.

3. Inquire into the sanitary inspection of dairy farms that supply milk to your community.

4. Make a study of the dehydration of foods as it is carried on at present.

5. Get information on the food of Orientals.

6. Keep a detailed record of your food intake for a week. Discuss this in the light of a balanced diet.

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CHAPTER 4

The Digestion and Utilization of Food

THE system of organs concerned with the process of digestion is referred to as the *digestive system* or *alimentary canal*. This system includes the mouth, pharynx, esophagus, stomach, small intestine, large intestine, rectum and various accessory digestive glands associated with these structures.

FUNCTION OF THE DIGESTIVE SYSTEM

In the digestive system food is prepared for absorption into the blood stream. Both mechanical processes such as mastication, swallowing, and movements of the stomach and intestines, and chemical reactions (digestion) are involved. Digestion is confined chiefly to (1) the more complex carbohydrates (polysaccharides and disaccharides) which are changed to simple sugars (monosaccharides); (2) proteins, which are broken down to amino acids; and (3) fats, which are converted into fatty acids and glycerol. The minerals and vitamins present in foods are not acted upon by digestive enzymes but are absorbed into the blood stream in the form in which they are ingested.

THE DIGESTIVE JUICES

The digestive juices secreted by the digestive glands are salivary juice, gastric juice, pancreatic juice and intestinal juice. The active constituents of these juices are known as *enzymes*. Enzymes are organic catalysts, which in minute quantities produce chemical changes without themselves being used up in the reaction. Digestive enzymes act by the process called *hydrolysis*, since they add water to the food molecules in the process of breaking them down into simpler molecules. By definition, digestion is the process whereby relatively complex and often insoluble compounds are hydrolyzed to soluble compounds of lower molecular weight. It consists of a series of hydrolytic reactions dependent upon the presence of specific enzymes. The compound an enzyme acts upon is known as the substrate.

Salivary Juice. The salivary glands are associated with the mouth

into which they secrete salivary juice (saliva) which contains two enzymes, *ptyalin* and *maltase*. Ptyalin splits starch into maltose, a double sugar. Maltase changes maltose to glucose, a simple sugar.

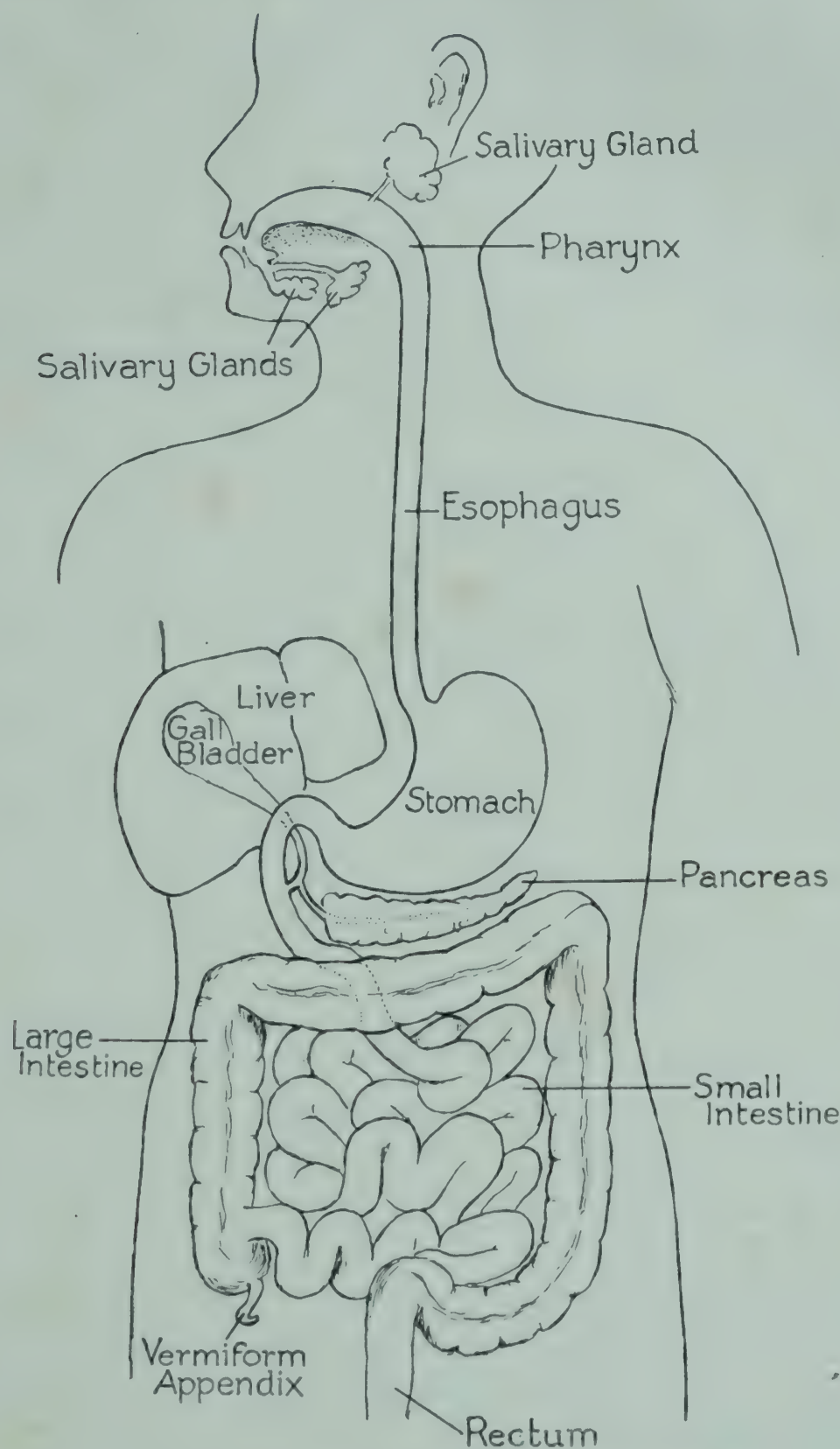


Fig. 7. A diagram of the digestive system.

Gastric Juice. The digestive fluid of the stomach is called gastric juice. It is secreted by glands in the mucous membrane lining the stomach and contains a little hydrochloric acid besides three enzymes, *pepsin*, *rennin* and a small amount of *gastric lipase*. Pepsin starts the digestion of

proteins, breaking them down to proteoses and peptones. Rennin has a coagulating action on the soluble milk protein *caseinogen* with the result that the milk is changed into a soft curd, or *casein*, which can be readily attacked by protein-splitting enzymes. Gastric lipase acts on fats, converting them into fatty acids and glycerol. Since only a very small amount of this enzyme is produced the digestion of fat in the stomach is of only slight importance.

TABLE 11
SUMMARY OF CHEMICAL DIGESTION

DIGESTIVE JUICES AND ENZYMES	SUBSTRATE	RESULTING PRODUCT
1. Saliva a. Ptyalin b. Maltase	Starch Maltose	Maltose (double sugar) Glucose (simple sugar)
2. Gastric juice a. Rennin b. Pepsin plus hydrochloric acid c. Lipase (small amount)	Caseinogen (milk protein) Proteins, including casein Fats	Casein (curds) Proteoses and peptones Fatty acids and glycerol
3. Pancreatic juice a. Trypsin b. Steapsin c. Amylopsin	Proteins (either intact or partially digested) Emulsified fats Starch	Peptones, peptids, amino acids Fatty acids and glycerol Maltose
4. Intestinal juices a. Erepsin b. Sucrase c. Lactase d. Maltase	Partially digested proteins Sucrose (cane sugar) Lactose (milk sugar) Maltose (malt sugar)	Amino acids Glucose and fructose (simple sugars) Glucose and galactose (simple sugars) Glucose

Pancreatic Juice. Pancreatic juice is produced by the pancreas, which is an important digestive gland located near the stomach. This juice enters the upper part of the small intestine through a duct and contains three important enzymes, *trypsin*, *steapsin* and *amylopsin*. Trypsin (a collective term for a group of enzymes) completes the action on proteins started by pepsin and acts also on those proteins that have escaped the action of pepsin. The final end products of protein digestion are amino acids. Steapsin splits fats into fatty acids and glycerol. It is aided by bile which enters the intestine from the liver. Bile is devoid of enzymes but contains bile salts which lower the surface tension of

fats and thus promote their emulsification, i.e., their separation into minute globules. In this form fat can be digested more readily. Amylopsin complements the work of ptyalin, converting starch into maltose.

Intestinal Juice. Located in the mucous membrane lining the upper part of the small intestine (duodenum) are digestive glands which secrete a fluid known as intestinal juice. Four enzymes are present in this juice, *erepsin*, *maltase*, *sucrase*, and *lactase*. *Erepsin* completes protein digestion. Maltase changes maltose into glucose. Sucrase acts on sucrose converting it into simple sugars (glucose and fructose). Lactase acts on lactose (milk sugar) breaking it down into simple sugars (glucose and galactose).

Table 11 summarizes the digestive process.

ABSORPTION OF DIGESTED FOOD

The process of *absorption* follows digestion. In this process the end products of digestion (amino acids, fatty acids and glycerol, and simple sugars) are absorbed into the blood and lymph, chiefly from the small intestine, and thus become available to every part of the body. The inner surface of the small intestine is intricately folded and densely supplied with little finger-like protrusions called *villi*. The surface area is thus greatly enlarged for the absorption of the products of digestion.

UTILIZATION OF ABSORBED FOOD

The simple sugars not needed for immediate use are taken from the blood stream by the liver and transformed into glycogen, an insoluble polysaccharide. The liver temporarily stores the glycogen and reconverts it into simple sugar (glucose) at a rate sufficient to maintain a certain level (0.1 per cent) of glucose in the circulating blood. Glucose is the primary fuel of the body, yielding 50 to 60 per cent of its energy. To yield energy it must be oxidized within the cells of the body. In this process it is broken down into carbon dioxide and water. The energy obtained from the process of oxidation is of two kinds: (1) heat energy which serves to keep the body warm, and (2) mechanical energy which makes possible the performance of the various activities constantly in progress in the body. The utilization of sugar by the tissues of the body is under the control of *insulin*, a hormone made by certain cells in the pancreas. When carbohydrates are eaten in excess of body requirements, they may be converted into fat and stored in the adipose tissues located in various parts of the body.

Amino acids are used by body cells for the synthesis of protein molecules and other complex compounds (hormones and enzymes). Excess amino acids can be utilized for energy production. To be used in this way, liver cells break down (deaminize, i.e., split off the NH_2 group) amino acid molecules forming urea, a waste product, and glucose, which is oxidized for energy. From 10 to 15 per cent of the energy of the body is usually obtained in this manner.

Fatty acids and glycerol are synthesized into fat which may be used by the body for the synthesis of more complex compounds (various lipids), for immediate oxidation to furnish energy, or in the construction of adipose tissue. As in the case of glucose the final end products of fat oxidation are carbon dioxide and water. The body derives about 30 per cent of its energy from the oxidation of fat.

To be completely oxidized fats must be oxidized simultaneously with glucose. When only partially oxidized acetone and other related substances which are toxic to the body are formed. The accumulation of such toxic compounds in the body is known as *ketosis*.

The mineral salts absorbed from the digestive tract enter into the formation of body cells and tissues, and some play important roles in the blood and other body fluids. Some aid in the maintenance of the acid-base balance of the body. Calcium is necessary for normal heart action as well as for the action of skeletal muscles. Together with phosphorus, calcium is an essential part of the skeleton.

The vitamins, as explained in Chapter 2, are utilized in various body processes. Without them, normal growth and development, reproduction, resistance to infection, and health in general would be impossible.

METABOLISM

Protoplasm is constantly in a state of flux, building up and breaking down compounds of various sorts. The entire series of chemical and physical changes constantly in progress in living matter is known as *metabolism*. Some of these transformations involve the synthesis of complex compounds from simpler substances (anabolism), others are concerned with the breaking down of complex compounds into simpler ones (catabolism). Both of these processes go on simultaneously and continuously during life. Protoplasm is an unstable, dynamic system, continuously maintaining itself through a balance of constructive and destructive metabolism. The life of the body is dependent upon the metabolic changes that are going on uninterruptedly in every living cell. The food we eat furnishes the materials for these reactions.

QUESTIONS FOR CLASS DISCUSSION

1. Name the parts that make up the digestive system.
2. Explain the function of the digestive system.
3. What is an enzyme? How do enzymes function?
4. Explain the term "hydrolysis."
5. Name the digestive juices.
6. Which enzymes are present in the salivary juice? What are the substrates they act upon? What is the end product of their combined action?
7. Which enzymes are present in the gastric juice? Name the substrates and the resulting products of their action.
8. Name the three enzymes of the pancreatic juice. Explain their actions.
9. What role does bile play in digestion?
10. Name the enzymes in the intestinal juice. Give the action of each.
11. What are the final end products of the digestion of carbohydrates? Of fats? Of proteins?
12. What is meant by absorption of food? Where does it occur?
13. Explain how the body utilizes: (1) glucose, (2) fatty acids and glycerol, and (3) amino acids.
14. Name the hormone that is necessary for the utilization of sugar by the tissues of the body.
15. What is the approximate amount of energy the body obtains from each of the three food components it is able to oxidize?
16. Discuss metabolism.

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CHAPTER 5

Relation of Body Weight to Health



IN order to have a sound body it must be somewhere near normal in weight. There is a relationship between weight and health. It appears that for each person, depending upon his age, height, body build and inherited tendencies, there is an optimum weight, a weight at which his body will function best. The closer he can get to his ideal weight the better from the standpoint of bodily vigor, resistance to disease and general well-being. Extremes of underweight or overweight are unfavorable to health. Many young people are underweight, while among those beyond the age of thirty a condition of excess body weight is common.

NORMAL WEIGHT

Tables intended to serve as a guide for judging correctness of weight, in regard to age and height, have been prepared. The older height-weight tables did not take into account the different types of body build, as slender, intermediate, and stocky, or small frame, medium frame and large frame. These earlier tables also allowed for a continuous gain in weight until old age was attained.

It is now believed that the average person reaches his complete normal development at about twenty-five years of age. Studies carried on by life insurance companies indicate that the normal weight at the age of twenty-five is the weight that should be maintained beyond that age to the end of life. The continuous accumulation of weight beyond the normal for age twenty-five is undesirable.

The newer tables give desirable weights for men and women of various heights and types of body frame (small, medium, large), who have reached or passed the age of twenty-five. For persons under twenty-five, weights slightly below those in the table are suitable. By deducting one pound for each year under age twenty-five, the tables are applicable for persons who are in the age range of fifteen to twenty-four years. Since it is impossible to prepare tables that give absolutely correct weights applicable to all persons alike, these tables should not be regarded as

TABLE 12
DESIRABLE WEIGHTS FOR MEN OF AGES TWENTY-FIVE AND OVER

HEIGHT (with shoes)	WEIGHT IN POUNDS (as ordinarily dressed)		
	SMALL FRAME	MEDIUM FRAME	LARGE FRAME
5 ft. 2 in.	116-125	124-133	131-142
5 3	119-128	127-136	133-144
5 4	122-132	130-140	137-149
5 5	126-136	134-144	141-153
5 6	129-139	137-147	145-157
5 7	133-143	141-151	149-162
5 8	136-147	145-156	153-166
5 9	140-151	149-160	157-170
5 10	144-155	153-164	161-175
5 11	148-159	157-168	165-180
6 0	152-164	161-173	169-185
6 1	157-169	166-178	174-190
6 2	163-175	171-184	179-196
6 3	168-180	176-189	184-202

TABLE 13
DESIRABLE WEIGHTS FOR WOMEN OF AGES TWENTY-FIVE AND OVER*

HEIGHT (with shoes)	WEIGHT IN POUNDS (as ordinarily dressed)		
	SMALL FRAME	MEDIUM FRAME	LARGE FRAME
4 ft. 11 in.	104-111	110-118	117-127
5 0	105-113	112-120	119-129
5 1	107-115	114-122	121-131
5 2	110-118	117-125	124-135
5 3	113-121	120-128	127-138
5 4	116-125	124-132	131-142
5 5	119-128	127-135	133-145
5 6	123-132	130-140	138-150
5 7	126-136	134-144	142-154
5 8	129-139	137-147	145-158
5 9	133-143	141-151	149-162
5 10	136-147	145-155	152-166
5 11	139-150	148-158	155-169

* Tables 12 and 13 are based on numerous medico-actuarial studies of hundreds of thousands of insured men and women. Courtesy of the Metropolitan Life Insurance Co.

By deducting one pound for each year under age twenty-five, the tables are applicable for persons who are in the age range of fifteen to twenty-four years.

standards to which all persons must conform to be considered normal in weight, but as guides for judging the correctness of a person's weight.

UNDERWEIGHT

Excessive thinness in children and young adults is disadvantageous. It may be due to inadequate food intake, poor dietary habits, disease or emotional factors. Malnourished individuals are usually listless and become fatigued very easily. Tuberculosis, frequent colds and anemia are more common in young persons who are underweight. A moderate amount of overweight in a young person is generally considered favorable to health.

The urge for leanness among young women is not without danger to their general health. A well-nourished body has great advantages over one that is undernourished. A moderate amount of fat, stored under the skin and elsewhere, is of value to the body. It insulates the body against too rapid heat loss and can be utilized as fuel in times of illness.

Underweight can usually be overcome by proper attention to diet and the adoption of a health program including exercise, fresh air, sunlight, adequate rest and sleep, and other measures conducive to health. In adults over thirty years of age underweight is not dangerous unless it is excessive.

OVERWEIGHT

Overweight, or obesity, represents an abnormal condition in which there is a large surplus of fat within the body. All obesity is the result of overeating. Fat comes only from food and obesity results only from eating more food than is required to meet the energy needs of the body. Obesity may be found in children but it is a problem that chiefly concerns adults. It develops frequently between the ages of thirty-five and forty-five.

Life insurance statistics definitely show that obesity is a dangerous condition. It increases susceptibility to diabetes, kidney diseases, heart failure, diseases of the arteries, liver and gallbladder diseases, cerebral hemorrhage and a number of other ailments. Excess weight of 10 per cent above normal increases the mortality toll about 20 per cent and the greater the amount of surplus weight the higher the death toll. Shakespeare apparently was aware of the dangers of obesity when he wrote:

Make less thy body hence, and more thy grace;
Leave gormandizing; know the grave doth gape
For thee thrice wider than for other men.

Psychiatrists have found that much of the overindulgence in food has an emotional basis. Emotional tension may express itself in the form of a strong, almost compulsive desire to eat much more food than the individual requires. Persons who are unhappy because they are being continually frustrated in meeting the problems of life often resort to food as a sedative and a source of comfort and satisfaction. Eating thus becomes an escape mechanism comparable to alcohol and drug addiction.

It is possible to avoid obesity in later life by keeping body weight from increasing after the age of twenty-five. To do this it is necessary to resist the urge to overeat. The individual may have difficulty in overcoming this urge unless he finds an answer to the question of why he is overeating.

CHANGING BODY WEIGHT

If there are no physical defects, body weight may be increased by modifying a well-balanced dietary in one respect, i.e., by increasing the amount of high-calorie foods. Foods rich in thiamine and riboflavin are helpful in that they increase the appetite and help to maintain the health of the digestive tract. Milk is a particularly valuable food for those who are underweight. If the daily food intake is about 500 calories in excess of one's energy needs a gain of about 1 pound a week should result. A sufficient amount of sleep is often an important factor in gaining weight.

Weight may be reduced by (1) eating less fat and carbohydrate food than the body requires for its energy output, (2) eating ample quantities of leafy vegetables, milk and fruits to provide vitamins, mineral matter and roughage, and (3) obtaining adequate exercise each day. Protein foods should not be reduced in amount unless the individual used them in excess. Starchy foods should not be entirely eliminated for the stored fat is oxidized much more readily and safely in the presence of carbohydrates. If the daily food intake is kept about 500 calories below the energy needs of the body a loss of 1 lb. of weight a week may be effected. Such a dietary forces the body to oxidize its own fat to meet the daily energy needs. Will power and perseverance are required to carry through a reducing program.

DANGERS OF REDUCING

It is dangerous to reduce weight rapidly; more than $\frac{1}{2}$ lb. per day is unsafe. Rapid reduction of fat leads to the production of fatty acids in excessive amounts. These acids cannot be neutralized as rapidly as they are formed and therefore may lower the alkaline reserve of the body

sufficiently to give rise to the condition known as acidosis. When fat is oxidized slowly in the body with other foods it does not become toxic.

Remedies for weight reduction are frequently advertised to the public. Some act as metabolic stimulants, while others are strong laxatives which hasten the progress of food through the digestive tract to such an extent that little of it is absorbed and utilized by the body. There is only one safe way to reduce and that is to modify a well-balanced diet by decreasing the amount of high-calorie foods. The dietary restriction is in calories only. Fad diets and reducing remedies must be avoided.

HEALTH PRACTICES TO BE ACQUIRED

Those individuals whose body weight deviates decidedly from the normal should attempt to correct this condition by acquiring the following health practices:

1. Those who are underweight should include at least a pint of milk in the daily dietary in addition to a sufficient amount of carbohydrates and fats. To balance the dietary, proteins, leafy vegetables and fruits must be included.
2. Those who are obese should develop the habit of controlling the appetite, always keeping the diet well balanced, however.
3. Avoid experimentation with antifat nostrums or diet fads.

QUESTIONS FOR CLASS DISCUSSION

1. Of what importance is correct body weight?
2. What relationship exists between weight and nutrition?
3. What allowances must be made in interpreting tables of average weight?
4. Of what value is a reasonable amount of fat in the body?
5. How does underweight affect health and longevity in young persons?
6. Outline a diet and a mode of life to increase the weight of an individual of your own age who needs to gain weight.
7. What dangers are associated with overweight?
8. Why are so many individuals past thirty above optimum weight?
9. Can overeating be due to emotional factors?
10. Give a suitable dietary for an obese individual.
11. What dangers are associated with reducing the weight of the body by means of antifat remedies?
12. Does your own weight deviate much from the optimum? If so, outline steps you may take to make it more favorable.

TOPICS FOR ORAL OR WRITTEN REPORTS

1. If requested to give health advice to a person of your age who is in a state of malnourished slimness, what suggestions would you make? State your reasons for the advice given.
2. Apply the problem stated above to an overweight person of about age forty.

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CHAPTER 6

Hygiene of the Mouth and Throat



MAINTAINING the health of the mouth and throat is an important factor in the health of the body. The normal mouth contains healthy mucous membrane, firm hard gums of a coral pink color, sound teeth, and a healthy tongue. The normal throat contains healthy tonsils. The teeth, gums and tonsils are the most important structures in the health of the mouth and throat.

A set of sound teeth is a valuable asset because it contributes to personal appearance in addition to providing an efficient chewing apparatus. Defective teeth make difficult or impossible the proper mastication of food and when teeth are infected the health of the body may become seriously impaired. There is an intimate relationship between the soundness of the teeth and the proper functioning of the remainder of the body.

CIVILIZATION AND TOOTH DECAY

Defective dentition and tooth decay are common afflictions of civilized man. Numerous recent studies on the prevalence of tooth decay have revealed that approximately 95 per cent of American children have dental defects. At the age of eighteen, nine teeth on the average have been attacked by caries and several have been lost. The number of dentists in the country is insufficient for the correction of the dental decay that now exists among our people. Because it has become so widespread in the population, dental disease has entered the category of a public health problem.

Most native races who still live truly primitive lives have excellent teeth although they have no dentists, toothbrushes or toothpastes and practice no dental hygiene. Under native conditions tooth decay is practically unknown among the Eskimos, but those Eskimos who have come in contact with the white man and receive food from traders—chiefly sugar, molasses and refined flour—suffer from dental decay. Although nature makes teeth of very hard materials so that they may be able to withstand the wear of a lifetime, the mode of life of civilized man has a deteriorating effect upon his dental structures.

TOOTH STRUCTURE

Each tooth consists of three parts, namely: (1) the *crown*, which is the exposed portion; (2) the *neck*, which consists of a narrow constriction at the edge of the gum; and (3) the *root*, which fits in a socket in the bone of the jaw. Some teeth have more than one root.

A tooth is composed chiefly of three different kinds of material: (1) enamel, (2) cementum and (3) dentine. *Enamel*, the hardest substance

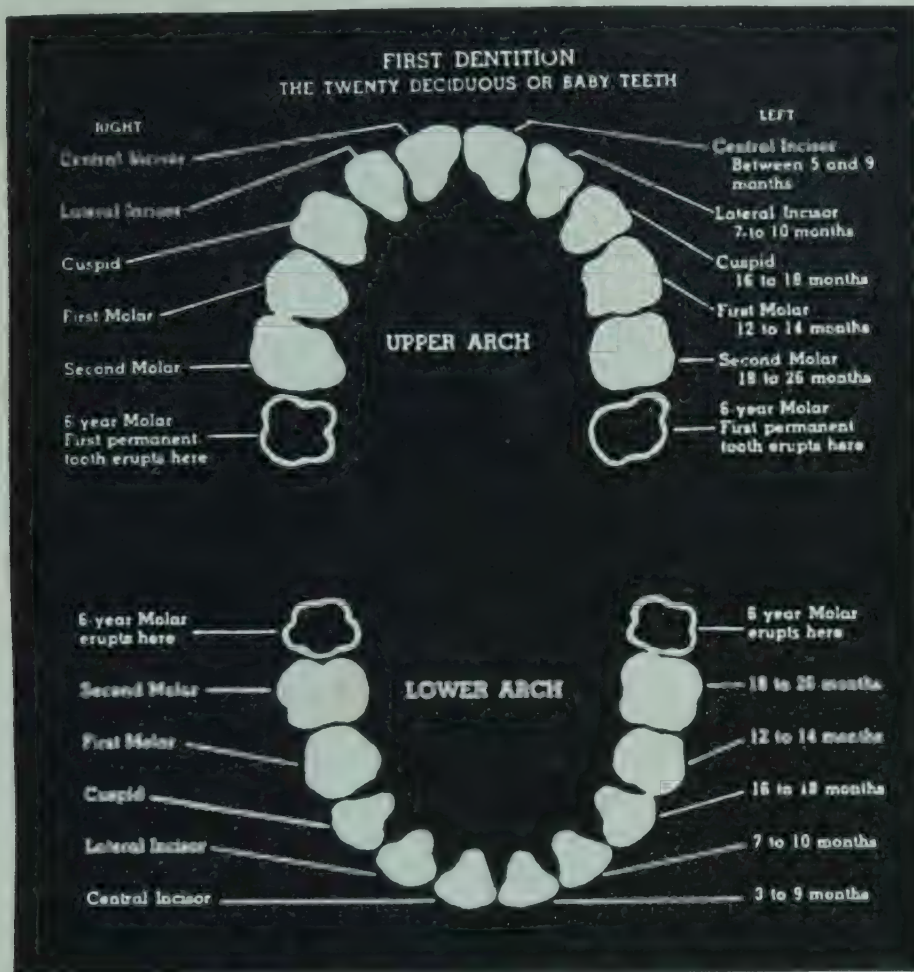


Fig. 8. First dentition: The twenty deciduous teeth. (Courtesy of Health Magazine.)

in the body, covers the crown. It is composed almost entirely of inorganic salts. *Cementum* is a bonelike substance which covers the root portion of the tooth. *Dentine* forms the main bulk of the tooth, and is permeated by a system of fine, parallel tubules which radiate outward from the pulp cavity. These tubules end at the junction of the dentine and enamel. Dentine is composed of about 67 per cent mineral salts and 33 per cent organic matter. Within the body of the dentine is a chamber, the *pulp cavity*, which contains small blood vessels and nerves held in position by a supporting framework of connective tissue fibers. These structures constitute the *dental pulp*. The blood vessels and nerves enter the tooth through the apex of the root.

The tubules within the dentine contain protoplasmic processes arising from cells (odontoblasts) within the pulp. These processes are capable of transmitting pain to the nerves in the pulp when irritated by chemical substances, such as products of decay or when subjected to temperature

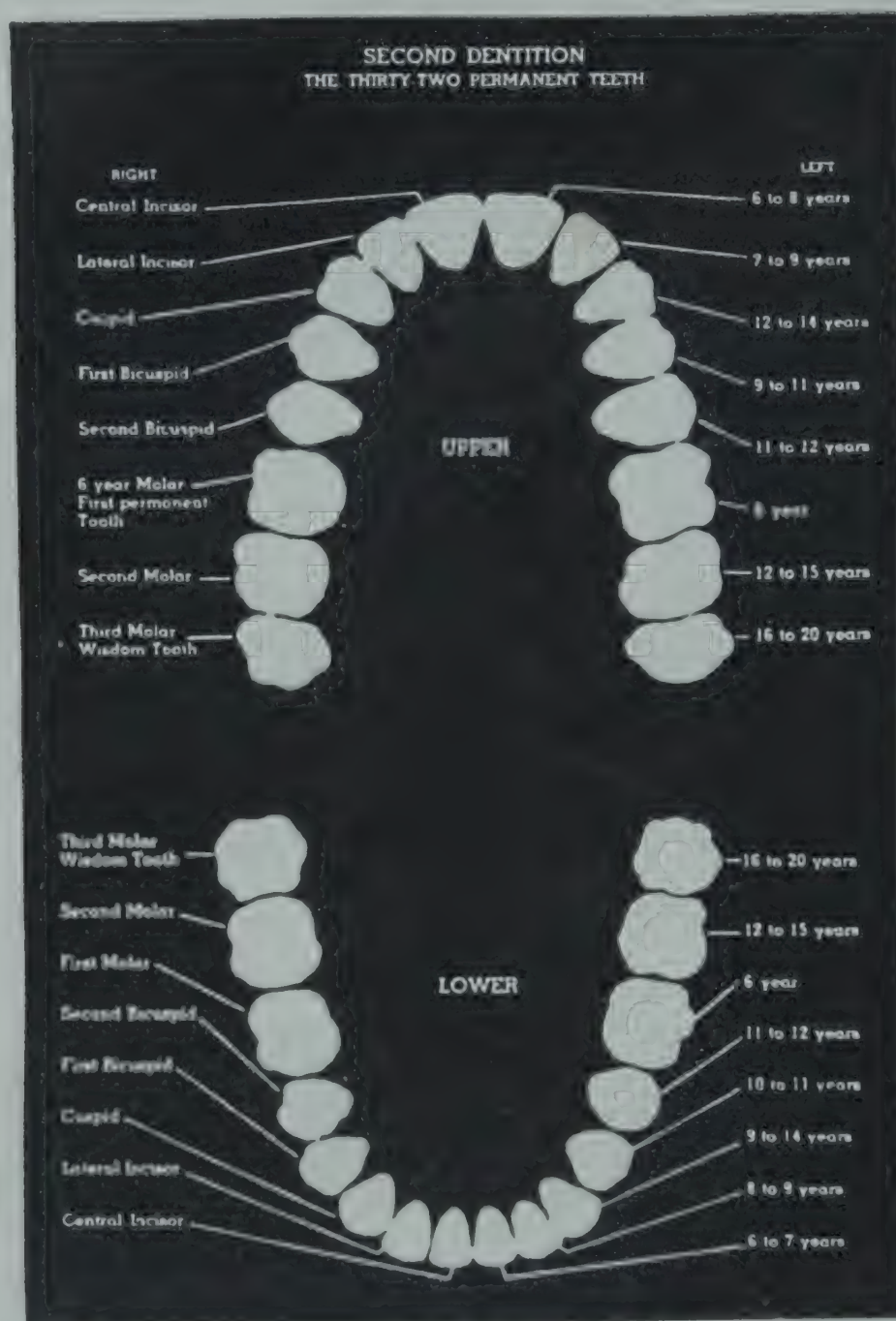


Fig. 9. Second dentition: The thirty-two permanent teeth. (Courtesy of Health Magazine.)

changes. Covering the root is the *periodontal membrane* which contains short, strong fibers that are embedded in the cementum of the root, holding the tooth firmly in its bony socket.

KINDS OF TEETH

Man's teeth differ in size and form. In each jaw the four front teeth, known as *incisors*, are chisel-like and are adapted for cutting. Next to these are the blunt-pointed *cuspid*s or *canines*, one on each side, adapted for

tearing. These are followed on each side by a pair of *bicuspid*s or *pre-molars* (two cusps on each crown), which are specialized for tearing and grinding. Beyond these on each side are three *molars*, the largest teeth in the mouth. Each has a broad grinding surface. The incisors and cuspids have one root, the bicuspid usually have but one root, but the molars have two or three roots.

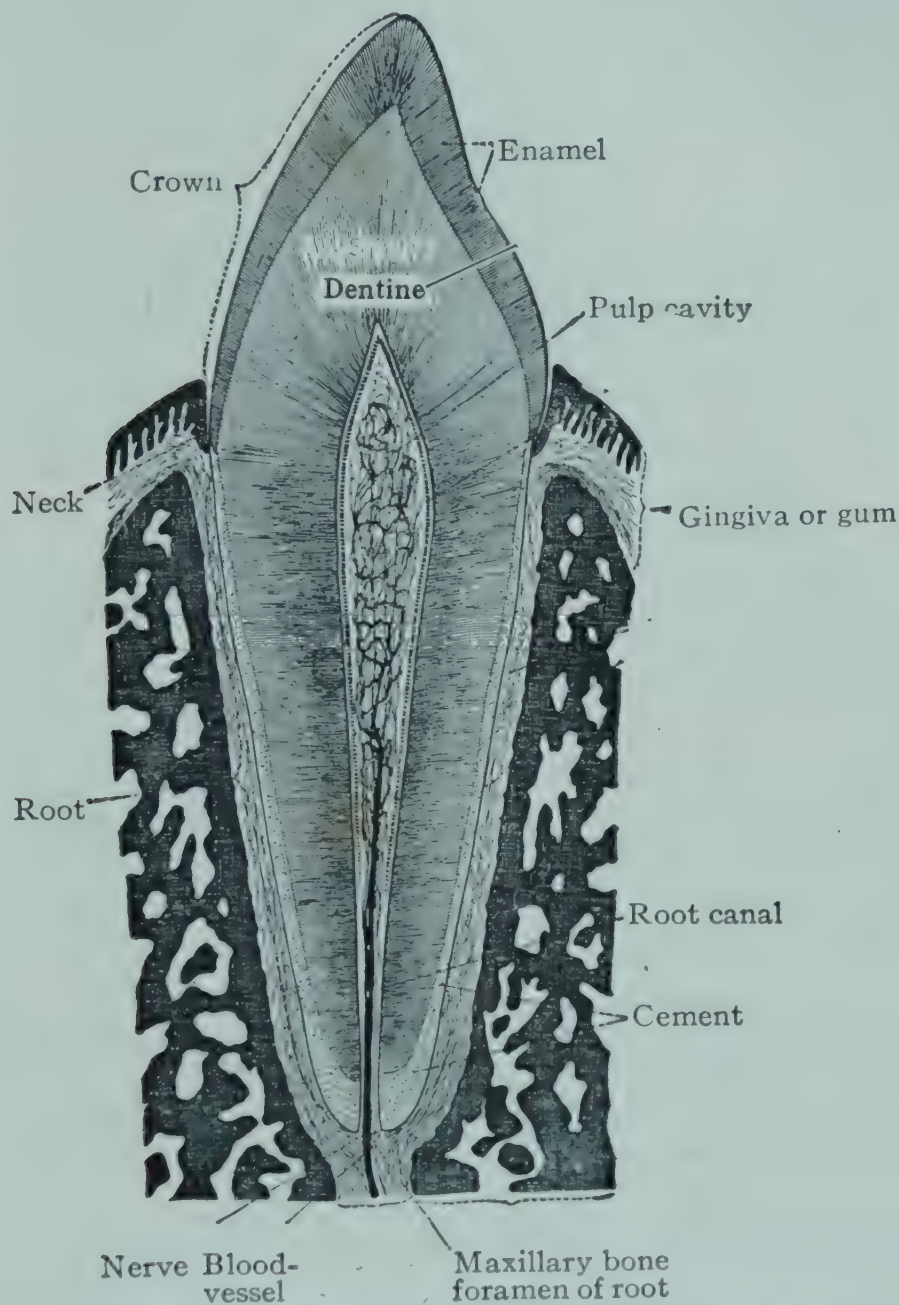


Fig. 10. Structure of a tooth. (From Sabotta and McMurrich, *Atlas and Text-book of Human Anatomy*, W. B. Saunders Co.)

Man has two dentitions; the first is the *foundation* or *deciduous dentition* (baby teeth), which begins at about the sixth month and is completed around the thirtieth month. This is followed by the second or *permanent dentition*. The first set is lost between the ages of six and thirteen years. Teeth of the second set begin to erupt at about the age of six years.

The deciduous teeth consist of four incisors, two canines (cuspids) and four molars in each jaw, a total of twenty teeth. The deciduous molars are

replaced by the permanent bicuspid. The permanent molars have no predecessors in the deciduous dentition. The first permanent teeth to erupt are the first molars, usually referred to as the six-year molars since they appear at about the age of six years. They erupt immediately in back of the deciduous teeth. Unfortunately parents often mistake these for deciduous teeth and fail to have them taken care of if they should be defective. About a year later the permanent central incisors begin to erupt. These are followed by the lateral incisors, the first and second bicuspid (replacing the first and second molars), the canines and the second and third molars.

TABLE 14
ERUPTION OF THE PERMANENT TEETH

	LOWER Age (in years)	UPPER Age (in years)
Central incisors	6- 7	7- 8
Lateral incisors	7- 8	8- 9
Cuspids	9-10	11-12
First bicuspid	10-12	10-11
Second bicuspid	11-12	10-12
First molars	6- 7	6- 7
Second molars	11-13	12-13
Third molars	17-21	17-21

The lower teeth erupt before the corresponding upper teeth.
The teeth usually erupt earlier in girls than in boys.
Reprinted by courtesy of the American Dental Association.

The third molars or wisdom teeth are the last to appear, erupting usually between the seventeenth and twenty-fifth year, making a total of thirty-two teeth in the permanent set.

PREMATURE LOSS OF DECIDUOUS TEETH

It is important that the deciduous teeth be kept in good condition until they are replaced by their permanent successors. They are important as space retainers in the jaws and in helping to guide the permanent teeth to their proper positions. The canines and the molars of the temporary set normally remain in the jaws until the age of ten or eleven years, about one-sixth of the average lifetime.

OCCCLUSION OF THE TEETH

When the teeth are in normal alignment in the dental arch, the upper front teeth overlap the lower ones, while the outer cusps or points of the

lower bicuspid and molars fit into grooves between the inner and outer cusps of the upper teeth. This puts the teeth in the best position for mastication. The normal coming together of the jaws in this manner is known as *occlusion*. When the teeth do not fit together normally the condition is known as *malocclusion*. A large percentage of people have some form of malocclusion. It may be caused by too early loss of deciduous teeth, mouth breathing, thumb-sucking in childhood or malnutrition during childhood.

IMPACTED TEETH

In some cases the jaws do not allow sufficient room for the third molars (wisdom teeth) to grow in their proper places. This causes them to become impacted, i.e., wedged into the jaw in abnormal positions. In some persons the third molars are completely absent.

FOOD IN RELATION TO TEETH

Since teeth are built from materials furnished by food, good nutrition is important for the formation of sound teeth. Experimental work with animals has shown that dietary deficiencies during the period of tooth development may impair tooth structure.

For the growth of good teeth the diet must provide adequate amounts of calcium and phosphorus, the basic minerals from which teeth are formed; vitamin D, which aids in the utilization of these minerals; vitamin A, which controls the formation of enamel; and vitamin C for the formation of dentine. Good nutrition from birth to about age fourteen is particularly important in building sound teeth. Once the enamel is completely formed the cells that produced it disappear. It can then no longer receive nourishment from the body. It is for this reason that the enamel is incapable of repair.

The normal development of teeth is favored by the mastication of hard, fibrous foods, especially firm raw fruits and vegetables. This stimulates the gums, the bones of the jaw and the teeth to develop in a normal manner. Such foods also help to keep the teeth clean.

The soundness of the teeth, however, will not necessarily keep them from decaying. There are factors other than the soundness of the teeth that play a role in their preservation.

DENTAL CARIES

Dental caries, or tooth decay, is one of the common afflictions of civilized man. Up to the age of eighteen the average person has had about nine

teeth attacked by decay. Caries is a destructive disease in which the hard structures of the teeth are broken down and the organic portions exposed to decay. Once it is started there is no cure other than prompt corrective service by a dentist. The dental repair bill of our nation constitutes a tremendous economic load on the American people.

The preponderance of evidence indicates that dental caries is caused by the action of certain bacteria (Lactobacilli) present in the mouth. A prominent member of this group is *Lactobacillus acidophilus*. These bacteria thrive on carbohydrates, particularly sugars, converting them into acids.

Because of the way in which the enamel is formed in the process of tooth development, exceedingly small pits and fissures are present on the surfaces of many teeth. Enamel starts its development from individual centers, forming small masses or "islands" which eventually unite to form a continuous mass covering the crown. Where the edges of these islands come together very small pits or fissures are frequently formed. These flaws in the enamel are so small that they are difficult to detect. When candy and sweetened foods such as cakes, pies, pastries and preserved fruits, or foods containing much starch such as refined cereals and white bread, are eaten, small particles become packed in these pits and fissures and there undergo fermentation. These food particles together with bacteria become covered with a tough mucinous plaque or film. The film adheres very firmly and is difficult to brush away. Here the acid-producing bacteria can act undisturbed on the food particles, resulting in the production of acids. Within two to five minutes they can produce enough acid to damage the underlying enamel. Because this occurs under a protective film the acid formed accumulates and eventually dissolves the minerals of the enamel in the localized area where it is produced. Thus a cavity is begun. When the decay reaches the dentine it spreads very rapidly through the dentinal tubules toward the dental pulp. Putrefactive bacteria digest the organic matter present in the dentine. Although the cavity in the enamel may be small, a large cavity may be formed in the dentine. Eventually it reaches the pulp through the dentinal tubules. As the cavity nears the pulp, pain may be felt at times, especially when hot, cold or sweet substances come in contact with the tooth. When the cavity involves the pulp violent pain ensues.

Drinking large quantities of acidulated sweetened beverages such as cola beverages, ginger ale or other so-called "soft drinks" may do harm to tooth enamel. The harm done by the acid in these beverages is aggravated by the sugar present. The frequent use of sugar, in the form of candy and

other sweets as well as in beverages and chewing gum, is the most important factor in causing tooth decay. In experiments in which refined carbohydrates were drastically restricted, the number of Lactobacilli dropped to or near zero, often within a few days.

Persons highly susceptible to dental caries have large numbers of Lactobacilli in their mouths. A few fortunate individuals do not suffer from tooth decay because ammonia is naturally formed in their mouths. Ammonia not only is detrimental to Lactobacilli but it also neutralizes acids.

There are geographic locations in the United States where the incidence of dental caries is conspicuously low. In these areas the drinking water contains fluorides (salts of fluorine). If the amount is one part of fluoride per million parts of water, or a little more, it has a decided inhibiting effect on dental decay, without producing any harmful effects. However, if the amount is greater than two parts per million parts of water the enamel of the teeth becomes mottled. Tooth mottling (dental fluorosis) occurs only if such water is consumed in childhood during the years that enamel is forming. It is now definitely established that persons continuously resident during the first eight years of life in areas where the public water supplies contain naturally at least one part per million of fluorine experience about 60 per cent less tooth decay than those living in areas where the water is devoid of fluorine. The nature of the caries-inhibiting properties of fluorine water is not known.

A number of studies have been initiated throughout the United States to determine the effects of the artificial fluorination of public water supplies upon the incidence of tooth decay. The amount added is usually one part of sodium fluoride to a million parts of water. It is not known whether artificial fluorination of water will produce the same reduction in caries as is found in areas where fluorine is naturally present in the water. The results of the many experiments now in progress will be available within a few years.

Another factor that appears to reduce tooth decay is sunshine. In a study conducted by the American Dental Association it was shown that children who live where sunshine is abundant have less tooth decay than those living in regions where there is less sunlight.

CONTROL OF DENTAL CARIES

Dental science is now in a position to control tooth decay. A number of procedures have been developed in recent years which if properly applied will greatly reduce the amount of caries in our population.

Topical Application of Fluorine. Experimental work involving thousands of children definitely has demonstrated that sodium fluoride will reduce the caries attack rate when it is applied to the surface of the teeth. This procedure is known as the topical application of fluorine. The proper application of this chemical to the teeth of children has reduced the amount of new decay by about 40 per cent. The protective effect of this treatment continues for three years or longer. Tooth decay already in progress is not benefited by this treatment.

In the application of this procedure the teeth are first given a thorough cleaning, after which sodium fluoride is applied to the teeth. This is followed at weekly intervals by three more applications. It is advised that all children between the ages of three and sixteen years be given this treatment. The ideal time to start the treatment is at the age of three. Those receiving the first treatment at this age should receive an identical series of treatments at the age of seven, ten and thirteen to protect the permanent teeth as they develop. The teeth of children appear to react better to this treatment than those of adults, but there is evidence that benefit, possibly of a lesser degree, may be had by adults.

Although it does not prevent all tooth decay, it is a great step forward, capable of reducing probable future tooth decay by about 40 per cent. In conjunction with other procedures recently developed and described in the following paragraphs, most of the dental caries can be prevented. The ultimate goal of dental health of all our people appears within reach.

Dietary Control. Since decay of teeth is initiated by acids resulting from the action of bacteria on refined carbohydrates, chiefly sugar, it can be controlled by restricting the intake of these foods. The decay remaining after the 40 per cent reduction resulting from the topical administration of fluorine can be controlled by dietary measures. It has been shown that tooth decay declines in direct proportion to the extent to which the sugar intake is reduced. Indulging in candy and other sweets, consuming sweetened beverages and chewing of gum are habits which are detrimental from the standpoint of caries control and also do great harm by preventing the proper nutrition of children as well as adults. The number of Lactobacilli in the mouth is proportionate to the amount of sugar consumed. The growth of Lactobacilli can be sharply curtailed by restricting the sugar intake. It is recommended that individuals susceptible to dental caries eliminate sugar and sweetened foods and reduce the carbohydrate intake to approximately 100 gm. for a period of two weeks to reduce the count of Lactobacilli in the mouth. After that period the amount of carbohydrate food may be gradually increased but sugar and sweetened

foods should remain on the restricted list. This dietary plan has been found to be successful in many cases in inhibiting the growth of acid-forming bacteria in the mouth. The restriction of sugar in the diet is one of most important factors in the prevention of dental caries.

Ammoniated Dentifrices. Experiments carried on with ammoniated dentifrices indicate that these preparations destroy Lactobacilli and also neutralize acids already formed. These dentifrices usually contain dibasic ammonium phosphate and carbamide. Although preliminary tests have indicated that ammoniated dentifrices may help prevent tooth decay, additional tests will need to be carried out to provide a proper evaluation of these products. A recommended routine is to brush the teeth with the ammonium dentifrice immediately after each meal and before retiring. It has been found, however, that morning and evening use alone is quite satisfactory. The regular use of this type of dentifrice brings about a sharp reduction of acid-forming mouth bacteria. Ammoniated mouth-washes are also available. It is recommended that the wash be swished around between the teeth for one minute after meals and after brushing the teeth.

Dental Inspection. Decay once begun must receive the professional care of a dentist. Frequent dental inspection and early treatment of small cavities is still an important procedure in the control of dental caries.

BRUSHING THE TEETH

Brushing the teeth removes fermentable debris from the accessible surfaces of the teeth and is, therefore, a desirable esthetic habit. It is recommended that the teeth be brushed after each meal. Dentifrices containing hard polishing agents should be avoided because they will scratch the enamel of the teeth. Daily use of such a dentifrice may do considerable damage to the teeth.

In brushing the teeth sufficient pressure should be exerted so that the bristles of the brush will be forced between the teeth. The brush should be rotated in small circular patterns and also given an up and down movement to get the bristles between the teeth. The masticating surfaces of the teeth should also be brushed.

The American Dental Association advises that the toothbrush have a straight handle and a small head with only two rows of tufts. The tufts should be equal in length.

The gum tissues may be benefited by massaging them with a finger tip smeared with toothpaste.

OTHER DISEASES OF THE ORAL CAVITY

Root Abscesses. When caries reaches the pulp of a tooth the decay may spread through the root canal to the apex of the root and give rise to a root-end infection known as a *root abscess*. Streptococci are usually present in such an abscess. They do not necessarily remain localized in the abscess but may invade the blood stream and lodge in various parts of the body, causing such conditions as arthritis (infection of joints), neuritis (nerve inflammation), endocarditis (infection of heart lining) or other infections. A root abscess thus may become a grave danger to the entire system. The individual is usually unaware of the presence of root-end



Fig. 11. X-ray showing root abscess a sequel to dental caries. (Courtesy of Eastman Kodak Company.)

abscesses because of the absence of local symptoms. Sometimes the abscess becomes noticeable as a “gum boil.”

Gingivitis. Gingivitis is an inflammation of the gum tissue (gingiva). The chief symptom is excessive bleeding of the gums upon brushing the teeth. It is a warning signal that some local condition in the mouth or a systemic condition needs professional attention. In some cases it is caused by irritants such as the accumulation of tartar (mineral matter precipitated from saliva) or food debris beneath the gum margin. When this is removed by the dentist the bleeding stops. Malocclusion of the teeth is sometimes the cause. It may also be due to systemic conditions that lower tissue resistance. Vitamin C deficiency may be a factor. Gingivitis may develop into a serious condition if neglected.

Pyorrhea. Pyorrhea (periodontitis) is a disease involving the periodontal membrane and the bone surrounding the teeth. The death of tissue around the roots causes the teeth to become loose in their sockets. Pus is discharged from the infected tissues. The term “pyorrhea” means liter-

ally a flow of pus. This disease is one of the chief causes of tooth loss among persons above the age of thirty-five years. It is a dangerous disease because the infection may spread to other parts of the body.

Vincent's Angina. This disease, also known as "trench mouth" because of its prevalence among soldiers in crowded camps and trenches during World War I, is readily communicable. It is characterized by inflammation and soreness of the gums. It may spread rapidly until it affects the entire mouth, the throat and the tonsils. The disease appears to be caused by two germs, the fusiform bacillus and Vincent's spirochete.

Infected Tonsils. The tonsils are small almond-shaped masses of lymphoid tissue occupying a space on either side of the throat. Their function appears to be a protective one since they contain white blood corpuscles whose task it is to engulf bacteria. Tonsils very frequently become infected. The infection may be acute or chronic. Acute tonsillitis, if not properly cared for, may develop into the chronic form. Many persons develop chronic tonsillitis without having had the acute form. Such individuals are often unaware of the fact that their tonsils are infected. Infected tonsils, like root abscesses on teeth, may lead to infections in other parts of the body.

HEALTH PRACTICES TO BE ACQUIRED

To preserve the health of the teeth and gums requires the establishment of the following health practices:

1. The habit of selecting a well-balanced dietary built around the protective foods, namely, milk, green leafy vegetables and fruits.
2. Reducing the intake of sugar and refined cereal foods to a minimum.
3. Taking advantage of recent advances in dental science, particularly in regard to the topical application of sodium fluoride to the teeth.
4. Faithful maintenance of proper tooth brushing, preferably with ammoniated dentifrices.
5. Regular visits to the dentist for tooth inspection and early treatment of small cavities.

QUESTIONS FOR CLASS DISCUSSION

1. What is the appearance of normal gum tissue and healthy mucous membrane of the mouth?
2. What is the condition of the teeth of civilized man compared with those of primitive peoples? What are probable reasons for this condition?
3. Name the parts of a tooth.
4. What is (a) dentine, (b) enamel, (c) cementum, (d) pulp, (e) periodontal membrane?
5. How are teeth held in their sockets?

6. Name the kinds of teeth in the adult human mouth.
7. How does the deciduous dentition differ from the permanent dentition in regard to the kinds and number of teeth?
8. Why is the proper development and care of the temporary teeth important?
9. What is occlusion? Malocclusion?
10. Discuss food in relation to the development of the teeth.
11. Why are hard, fibrous foods of value to the teeth and gums?
12. Discuss dental caries.
13. Explain the theory most generally accepted concerning the cause of tooth decay.
14. What is the relation of fluorides to tooth decay?
15. What is meant by the topical application of fluorine to the teeth?
16. Of what importance is the restriction of sugar in the diet in relation to dental caries?
17. How do ammoniated dentifrices affect *Lactobacilli*?
18. What is the best type of toothbrush to use for the proper cleansing of the teeth?
19. Which kinds of dentifrices should be avoided?
20. What are root abscesses? Why are they dangerous to health?
21. What is gingivitis?
22. What is pyorrhea? Why is it a dangerous disease?
23. What is Vincent's angina?
24. Why are infected tonsils dangerous to health?
25. State the general measures necessary to keep the mouth healthy.

TOPICS FOR ORAL OR WRITTEN REPORTS

1. Make a survey of the condition of the teeth of ten, twenty, or more of your acquaintances. Determine the number of teeth that have been filled, the number that have artificial crowns, the number lost and the number that need dental attention. Tabulate your findings for presentation to the class.
2. Make a study of septic sore throat, in regard to its cause, mode of transmission and seriousness of the infection.

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CHAPTER 7

Value of Physical Activity

PHYSICAL activity has played a prominent role in the development of the human race. Through the long centuries that man led a primitive mode of existence the human body became adapted to a life of considerable muscular activity. Primitive man's adjustment to environment involved vigorous use of his muscles, since he gained his livelihood by muscular power.

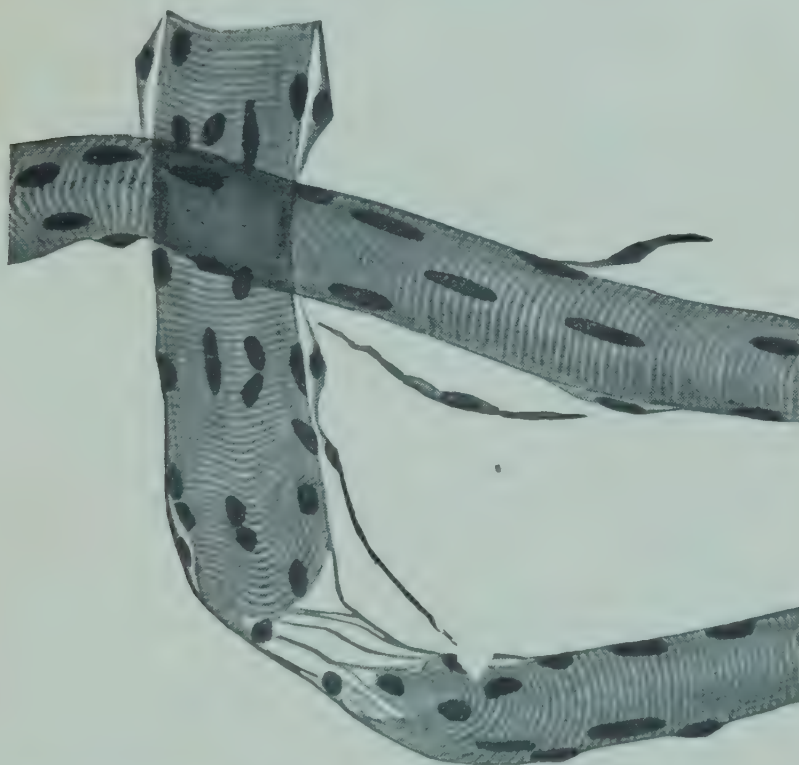


Fig. 12. Two skeletal muscle fibers, showing the characteristic cross striations. (Maximow and Bloom, Textbook of Histology.)

The sedentary mode of life, made possible by our present mechanical age, deprives many persons of adequate physical activity in the course of their daily duties. Man is not by nature fitted for a purely sedentary existence; he has inherited a body structure which depends upon muscular activity for its normal functioning. In his life adjustments the muscular system is of supreme importance. The vital organs need the stimulus that muscular activity provides. The heart, lungs, stomach, intestines, kidneys, liver and brain function best when exercise is a part of the daily routine of living. To be a successful mental worker requires not only mental ability

but also physical vitality and endurance which muscular exercise helps to maintain. Wholesome exercise is one of the most important aids in the maintenance of health and efficiency. It is particularly important in youth. The muscular system cannot be safely neglected without harm to the body.

The modern conception of man is that he is a body-mind unit, rather than a being composed of two distinct parts, body and mind. He is an integrated unit, an organization of structures and functions bound together in one personality. His brain alone does not determine his thoughts; his muscles, digestive system, circulatory system and other organs play a sig-

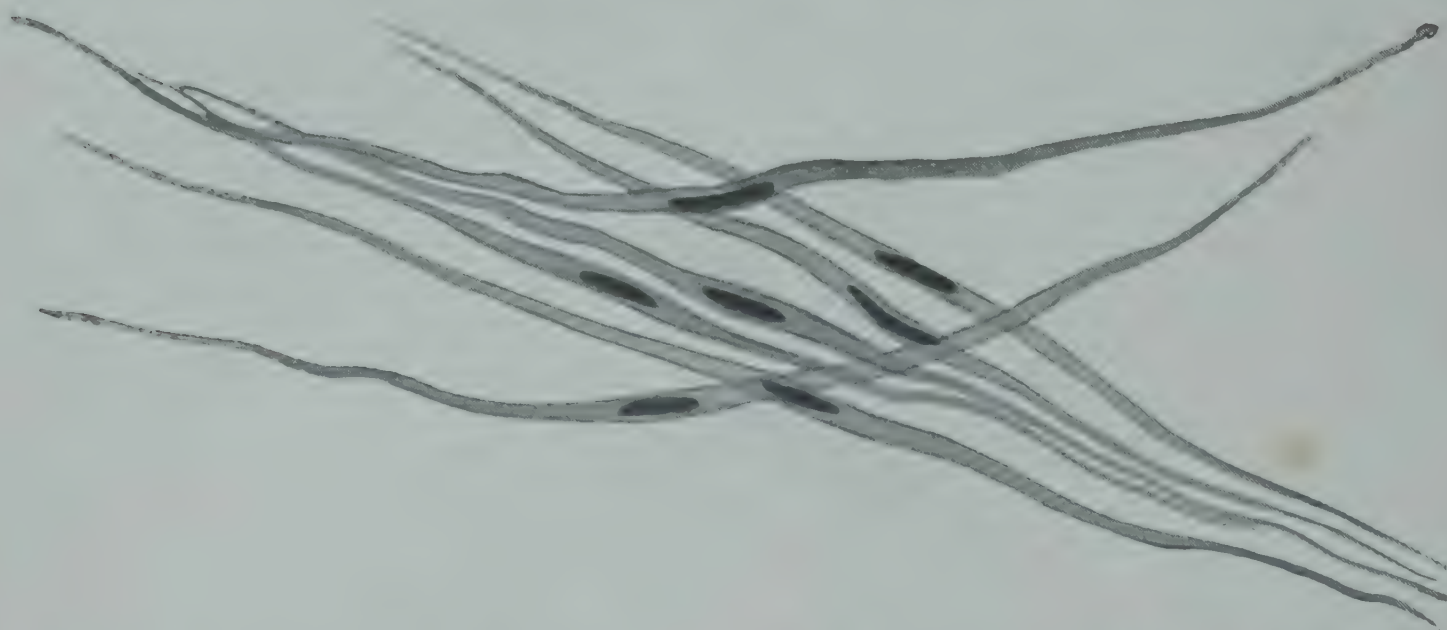


Fig. 13. Spindle-shaped cells of smooth muscle. (Maximow and Bloom, Textbook of Histology.)

nificant role in his mental processes. As one person expressed it, "what we are in our nerves and muscles controls our acts more than what we think in our brains." All functions of the body-mind unit are influenced advantageously by proper physical activity. Definite values will accrue to the individual who includes a suitable amount of bodily activity in his daily program of living.

THE MUSCULAR SYSTEM

The muscular system is specialized for motion, enabling man to carry on various movements in response to the stimuli of his environment. In the human body there are three types of muscles: (1) *skeletal* or voluntary striated muscle, (2) *smooth muscle* and (3) *cardiac* or involuntary striated muscle. Most of the skeletal muscles are attached to the bones of the body in such a way as to produce all of the external movements of the body and its parts. Smooth muscles make up the greater part of the walls of the alimentary canal, and are present in the walls of the blood vessels.

urinary bladder and the uterus. Cardiac muscle occurs only in the heart. The smooth muscles and the cardiac muscle are sometimes collectively referred to as visceral muscles because they are found in the internal organs (viscera).

A skeletal muscle is made up of a large number of microscopic, thread-like units called fibers, bound together with connective tissue. Each fiber

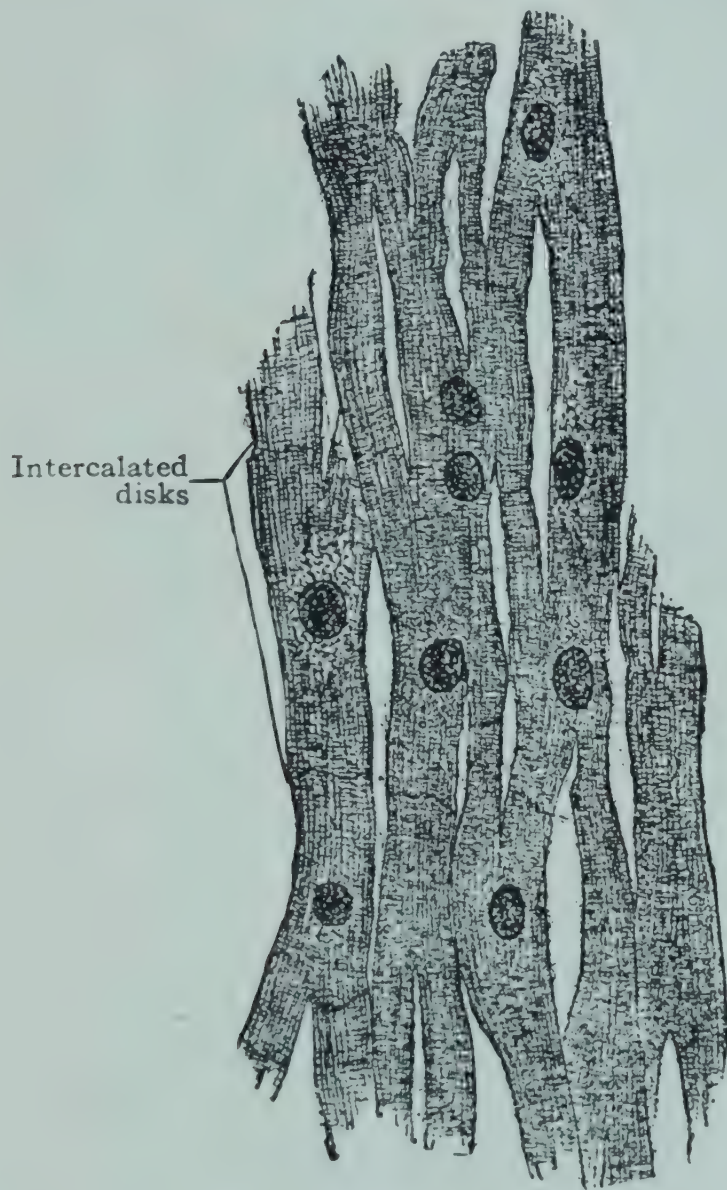


Fig. 14. Cardiac muscle tissue. (From Addison, Piersol's Normal Histology. Courtesy of J. B. Lippincott Co.)

is an elongated cell varying in length from 1 to 40 mm., and is surrounded by a connective tissue sheath (sarcolemma). Within each fiber there are numerous exceedingly thin, cross-striated fibrils (myofibrils) arranged parallel to one another. It is because of the presence of these cross-striations in the fibrils that this type of muscle has a striated appearance in microscopic sections. At each end of the muscle the fibers terminate but the connective tissue sheaths extend beyond them. The two ends of a muscle are usually not alike. At one end the muscle tapers and the connective tissue sheaths become massed together into a tough strand known

as a *tendon*. The tendon is fastened to a bone. The opposite or broader end is without a tendon and is attached quite directly to a bone. When a muscle contracts, at least one of the bones to which it is attached is forced to move.

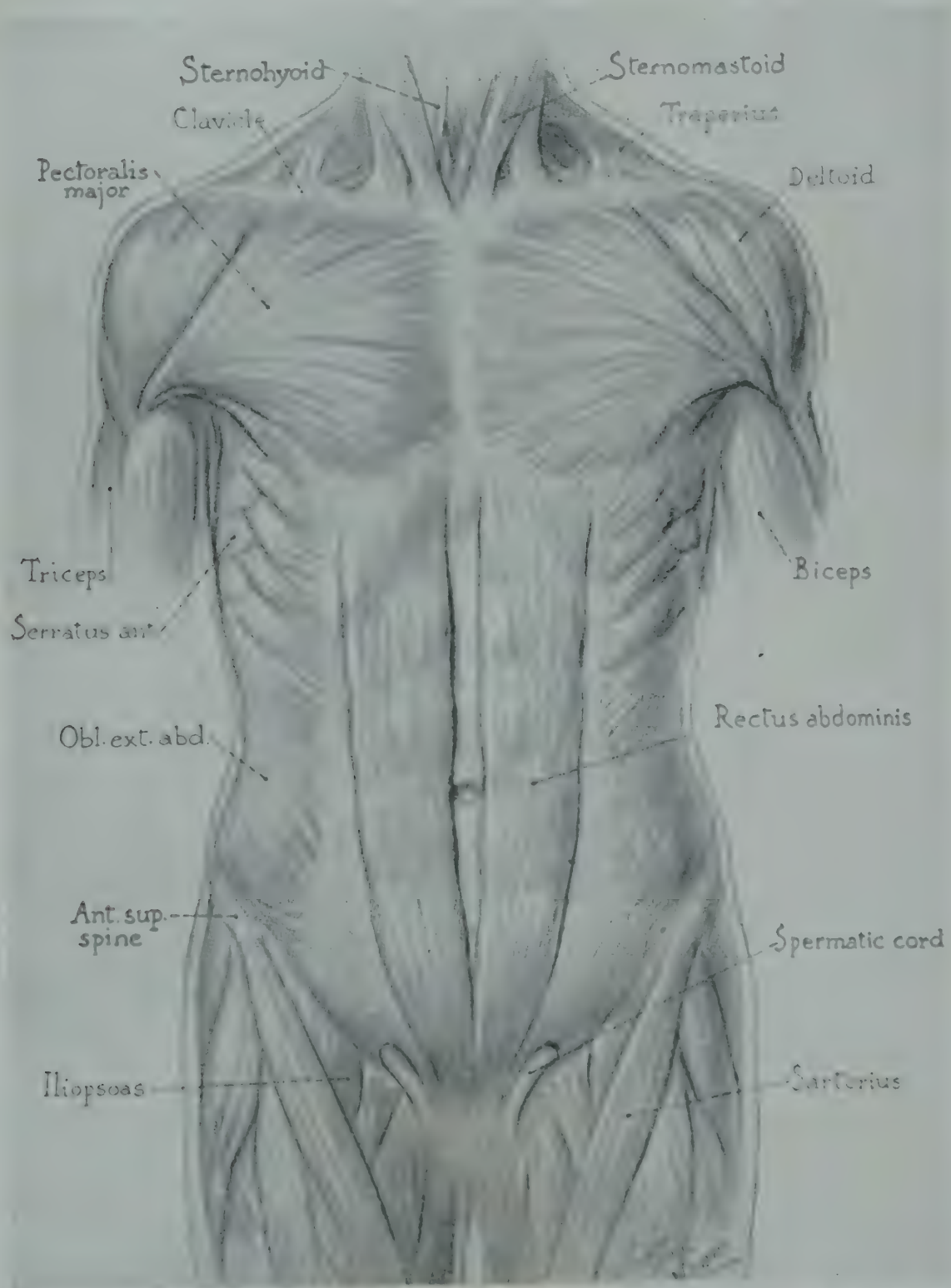


Fig. 15. Superficial muscles of the trunk, front view. (Courtesy of S. H. Camp and Company.)

Smooth muscle is made up of elongated spindle-shaped cells which may attain a length of 0.5 mm. It has no cross striations. It contracts and relaxes very slowly and is capable of contracting in the absence of nerve impulses. Cardiac muscle is striated like skeletal muscle but is involuntary

like smooth muscle. The cells are not separated from one another, but form a continuous network of communicating fibers, joined end to end.

When a muscle contracts it becomes shorter and thicker. The contraction of skeletal muscles is translated into motion by the pull exerted on the bones. Skeletal muscles contract only in response to impulses that reach them by way of the nerves. Much of the work of the brain and other parts of the nervous system is concerned with the action of these muscles.

Skeletal muscles are never completely relaxed since some of the fibers are always in a state of slight contraction. This condition, known as *muscle tone*, keeps the muscles in a state of readiness for action and enables them to respond at once to impulses received from the nervous system. Normal activity keeps muscles in good tone while disuse leads to loss of tone.

To keep the muscles, which form so large and important a part of the body substance, in good condition, it is necessary to provide them with adequate activity to maintain their functional integrity as well as the proper coordination between the nervous and muscular systems. The coordinated activity of the skeletal muscles is the basis of grace, agility and proficiency in sports and games. Every normal individual needs sufficient muscular development and motor skill to walk with ease and grace, to maintain correct body carriage and engage in outdoor games and sports. Excessive muscular development, however, is not desirable.

It is important to understand that physical activity is beneficial not alone to the muscles but also to the vital organs of the body. Exercise has a profound effect upon the whole body in that it steps up all of its normal activities. It is largely because of this that muscular activity is so important to the body-mind unit.

EFFECTS OF EXERCISE ON BODY FUNCTIONS

Flow of Blood and Lymph. One of the greatest benefits derived from exercise is the improved circulation of blood and lymph to all parts of the body, which it brings about. The blood has several important functions, namely (1) to absorb nutrient material from the intestine and distribute it throughout the body, (2) to take oxygen from the lungs and convey it to the tissues, (3) to remove waste products from the tissues, and (4) to distribute and equalize body heat. To perform these functions effectively the circulatory system requires the stimulus of muscular activity. Exercise causes the heart to beat more forcibly which in turn makes the blood flow more rapidly and assures a uniform distribution of blood to all tissues of the body. Lack of muscular activity tends to cause the blood to stagnate in the abdominal viscera, resulting in congestion of blood in these parts.

The squeezing effect of muscular contraction upon the veins accelerates the return of the blood to the heart and causes the lymph which surrounds the cells to circulate more freely. The increased motion of the diaphragm (a large dome-shaped muscular partition between the thoracic and abdominal cavities), resulting from the deeper breathing which comes with exercise, causes a temporary but repeated pressure on the abdominal organs which produces a pumping action that improves the circulation in the abdominal viscera and assists the blood in the large veins in its return to the heart. By stepping-up the circulation of blood and lymph, exercise exerts an important effect upon all of the cells of the body in that it im-



Fig. 16. Outdoor sports promote good health. (Courtesy of Cranbrook School.)

proves their functioning. Exercise is beneficial to the normal heart for it keeps it well nourished, in good tone, and prolongs its usefulness. Since the heart is a muscular organ, it must be given a sufficient amount of work to maintain normal strength.

Respiration. Physical activity affects the respiratory system in that it increases the demand for oxygen. Deeper and more rapid breathing replaces the shallow breathing associated with sedentary life. This strengthens the respiratory muscles and helps to maintain the flexibility of the chest, and brings into use all of the air sacs of the lungs, thus helping to keep them in normal condition. It is conceivable that outdoor exercise consistently taken plays an important role in the prevention of pulmonary tuberculosis, particularly in young people.

Digestion. Exercise brings about an increased assimilation of food and thus creates a demand for food. This results in a normal appetite which is conducive to good digestion, and a more complete utilization of food in the tissues of the body. Exercise also improves the muscle tone of the alimentary canal and thus helps to maintain normal peristaltic movements. It plays a rather important role in the prevention of constipation.

Excretion. Because of the increased chemical activity of the cells waste products are given off more readily. There is also a more complete reduction of wastes due to increased oxidation. Wastes are expelled from the body more rapidly through the kidneys, intestines, lungs and skin.

Mental Functioning. Light or moderate muscular activity improves mental functioning. It increases mental alertness and zest for meeting and solving the problems of everyday life. It diverts the thoughts into fresh channels and offers an emotional outlet to the cares and tribulations of daily life. The relief of emotional tension thus experienced reacts favorably upon the physical state of the individual. The sense of well-being resulting from exercise improves the individual's outlook on life. The mental phase of the body-mind unit needs the support of a vigorous body to sustain the superstructure of intellectual life necessitated by the competitive intellectual struggle of modern life. Many of the able men and women of our nation know the value of maintaining bodily vigor to support their mental tasks.

DESIRABLE TYPES OF EXERCISE

To produce an effect similar to that obtained by primitive man from his daily activities, muscular exercise for modern man should include bending, twisting, stretching, running, climbing and throwing. Those activities which include the element of enjoyment and can be carried on out-of-doors are the most desirable. Games and sports which involve the big muscles of the trunk, thighs and shoulders are strongly advocated. Among these are baseball, tennis, basketball, badminton, handball, skating, skiing, rowing, swimming, hiking and bicycling.

Swimming is one of the best exercises for the development of the chest and breathing muscles. The rhythmic motions help to develop a graceful carriage. It is advisable that every able-bodied person acquire the art of swimming.

Bicycling is a healthful form of exercise. The bicycle may be used for week-end trips or longer tours during summer months. Overnight accommodations may be obtained at youth hostels at nominal cost. These are

also available to hikers. A moderately good bicyclist can travel at the rate of eight to twelve miles per hour and cover fifty miles in a day without overexerting himself.

Walking, especially brisk walking, brings into play most of the large muscle groups of the body. It is a form of exercise available everywhere for everyone. Walking calls for suitable shoes and clothing and offers an opportunity to give thought to correct posture and improve body carriage. A hiking trip is a desirable way to spend a week-end or a vacation of several weeks or months. After some toughening up a person in good organic condition can walk fifteen miles or more a day.

For those who are unable to take part in outdoor games or sports, formal gymnastics and calisthenics are of value. They are especially helpful in correcting certain physical defects and poor posture.

AMOUNT OF EXERCISE NEEDED

To get the full benefit from exercise it should be performed with regularity, i.e., become a part of the daily program of living. Spasmodic bouts of exercise are not very beneficial, and if too severe may do more harm than good. The amount of exercise needed per day varies with different individuals. Because individuals react differently to similar amounts of exercise, some require more than others. A suitable amount will produce the sensation of having been physically active without causing undue fatigue. There are other factors besides time that determine the amount of exercise needed. The more important of these are the speed of performance and the amount of strength required. Those that require much speed should be relatively short in duration. This is also true of those that require powerful muscular exertion. A sedentary person, no matter how busy he is, should take time out for exercise. The busier one is, the greater the need for muscular exercise.

HARMFUL EFFECTS OF OVERACTIVITY

Exercising the muscles should not be overdone. Besides favorable effects, harmful reactions may follow when exercise is too strenuous or unsuited to the individual. Those with impaired health may be harmed by intense and sustained exercise, especially if the heart is defective. Those with impaired hearts should exercise only under the advice of a physician.

If exercise is taken too soon after recovery from infectious disease, injury to the heart may result. Healthy young people may safely engage in strenuous activities but after the age of forty years intense exercise may do harm to persons not accustomed to vigorous physical activity.

FORMING THE HABIT OF EXERCISING

Those individuals who do not obtain a sufficient amount of physical activity in their daily work should develop the habit of taking adequate daily exercise, preferably in the open air. The most satisfactory type of exercise is that which can be taken in the form of play. One is more likely to develop the habit of exercising when the exercise is enjoyable. If games or sports cannot be indulged in, walking is probably the next best type of regular exercise. To develop the habit of exercising requires determination not to let anything interfere with one's regular exercise period.

QUESTIONS FOR CLASS DISCUSSION

1. Why is physical activity necessary to health?
2. What is meant by the statement that man is a body-mind unit?
3. Name the types of muscles found in the body. Where are they located?
4. Describe the structure of a skeletal muscle.
5. What are tendons?
6. Explain the meaning of the term "muscle tone."
7. How much muscular development does one need?
8. How does physical activity affect the flow of blood and lymph?
9. Just how does the motion of the diaphragm affect the circulation of blood?
10. What effect does exercise have on respiration?
11. How does exercise affect the process of digestion?
12. What effects does exercise produce on excretion?
13. Does exercise have a bearing on mental functioning? Explain.
14. Give desirable types of exercise.
15. Discuss the amount of exercise needed.
16. Summarize the beneficial effects of exercise on the body.
17. Is exercise ever harmful?

TOPICS FOR ORAL OR WRITTEN REPORTS

1. What arguments would you use to convince a sedentary person who fails to take physical exercise that he should adopt a program of living which includes adequate physical activity?
2. Study advertisements that appear in certain magazines offering to sell instruction by mail that will convert the sedentary person into a strong-muscled individual. Is it to the best interests of the sedentary person to follow such a course of treatment?
3. What is "second wind"? Of what significance is it to an athlete?
4. Outline a program of physical activity suited to your needs.
5. Prepare a report on the national significance of an adequate physical education program.

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CHAPTER 8

Posture and Its Bearing on Health

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BY posture is meant the characteristic form in which the body is maintained during its various activities. One of the adjustments to environment man must make is to the force of gravity. Being a biped, man must balance himself against this force to maintain his upright position. How well he succeeds in accomplishing this feat is of great importance since good body poise is essential to correct mechanical use of the body and, therefore, is a requirement for physical fitness and healthful living. Body poise is important also in maintaining the normal attractiveness of the human body. Since good posture involves mechanically correct body carriage, it always has been recognized in military life as of great value from the physical as well as psychological standpoint. It is evident that proper body carriage is of similar worth to the civilian population. At the United States Military Academy (West Point) each cadet is built up in body and corrected in posture. Upper classmen admonish plebes when they meet them on the reservation with statements such as "keep your chin in out of the breeze," "drag in your stomach," or "squeeze your shoulders back." They thus become posture conscious from the very beginning of their military career.

#### ADVANTAGES OF GOOD POSTURE

Correct mechanical use of the body permits the internal organs to function efficiently. The high position of the chest allows the maximum of space for the expansion of the lungs and free action of the heart. The diaphragm is permitted to move freely, thus assuring normal breathing movements and ample aeration of the lungs. The organs of the abdomen are kept from shifting out of normal position and are able to work without being cramped. The vital body functions, respiration, circulation, digestion, excretion and coordination of body activities can be carried on unimpeded when the body is in physiologic balance.

A properly poised body is economical in the use of energy and efficient in its movements. Less energy is required to balance the body against the



pull of gravity and a maximum of energy is available for the accomplishment of any tasks that are to be performed. Greater efficiency can be

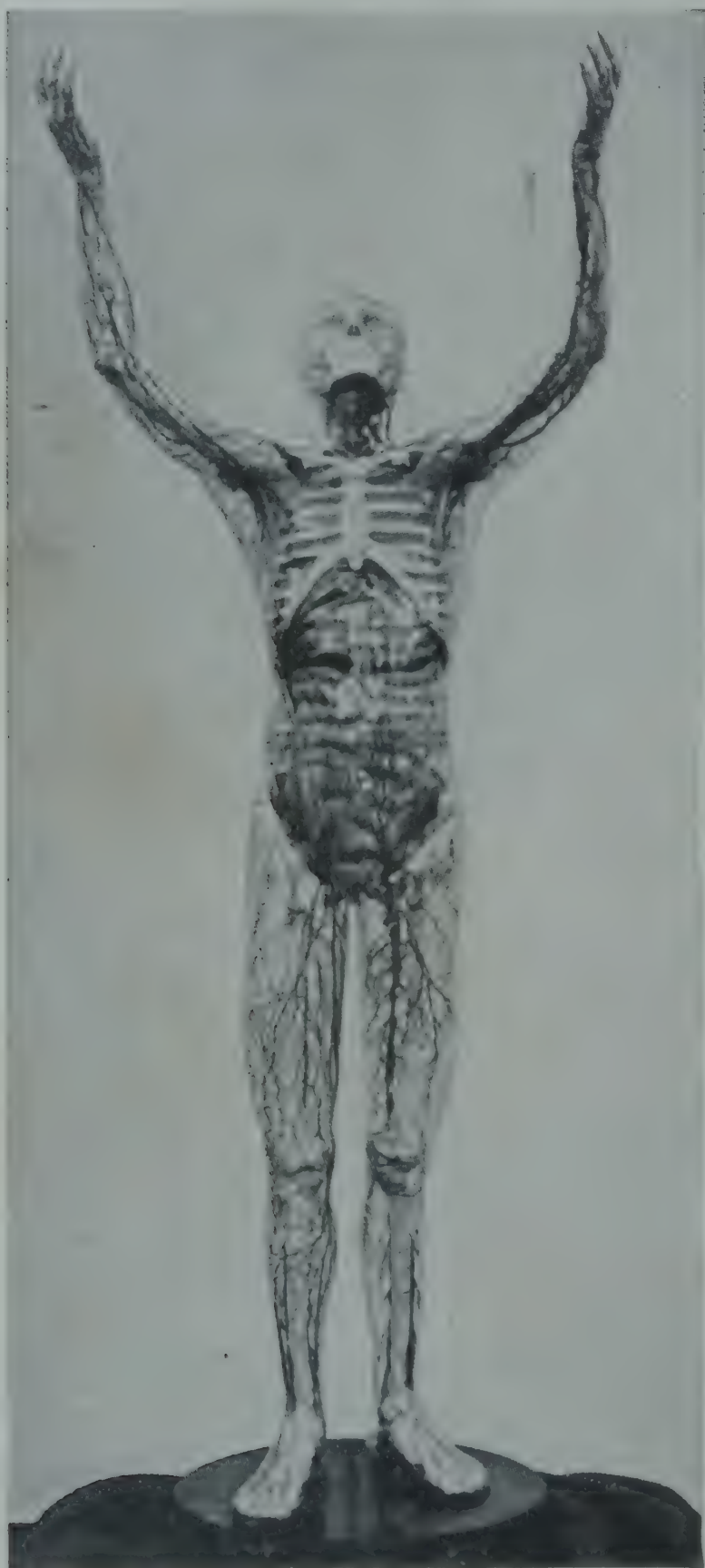


Fig. 17. Transparent model of a man showing position of abdominal viscera in a well-poised body. (Photograph courtesy of Buffalo Museum of Science.)

acquired in the mastery of the skills and technics involved in the various arts, handicrafts and sports when the body is correctly aligned than when it is out of alignment.



Good posture is a desirable social asset because of its esthetic value. The human body makes a poor showing when part of its anatomy is out of alignment. The grace and attractiveness of the human body are dependent in a large measure upon its proper mechanical use. A well-poised body reveals a good fighting spirit to carry on the battle of life.

### MECHANICS OF THE HUMAN BODY

The skeleton and the muscles are the chief structures involved in body mechanics. The skeleton, specialized for support and protection, constitutes the main supporting framework of the body. It consists of more than two hundred bones joined together by ligaments (sheets or cords of tough fibrous material) and activated by muscles, making movement possible at many points. The bony framework with its muscular attachments constitutes a surprisingly efficient machine which is subject to mechanical laws and forces. In addition to making movement possible, the skeleton also gives form and shape to the body and serves as a weight-bearing structure.

The skeleton consists of two main divisions, the *axial* and *appendicular*. The axial skeleton includes the skull, vertebral column (back bone or spine), ribs and sternum (breast bone). The appendicular skeleton consists of the shoulder or *pectoral girdle* and the pelvis or *pelvic girdle*, together with the bones of the arms and legs. The pelvic girdle is strong and massive and serves as a supporting base for the spinal column.

The vertebral column is a highly important structure because it forms the main skeletal axis of the body and houses and protects the spinal cord. It is a supporting column designed to sustain the weight of the head and trunk and consists of a linear series of twenty-four bones known as *vertebrae* (singular, *vertebra*) at the base of which is a large wedge-shaped bone, the *sacrum*, which consists of five vertebrae fused together. The sacrum is firmly joined to the bones of the pelvis by strong ligaments which permit practically no motion in this joint. Attached to the end of the sacrum is the *coccyx* which consists of four small, fused bones. The bodies of the vertebrae are not in actual contact with one another but are separated by disks of elastic cartilage which act as shock-absorbing cushions. Because the vertebrae are able to rotate slightly upon one another, the trunk may be turned from side to side. The compressibility of the cartilaginous disks permits bending forward, backward or to either side.

The twenty-four vertebrae may be subdivided into three groups: seven in the neck called *cervical vertebrae*, twelve in the thoracic region called



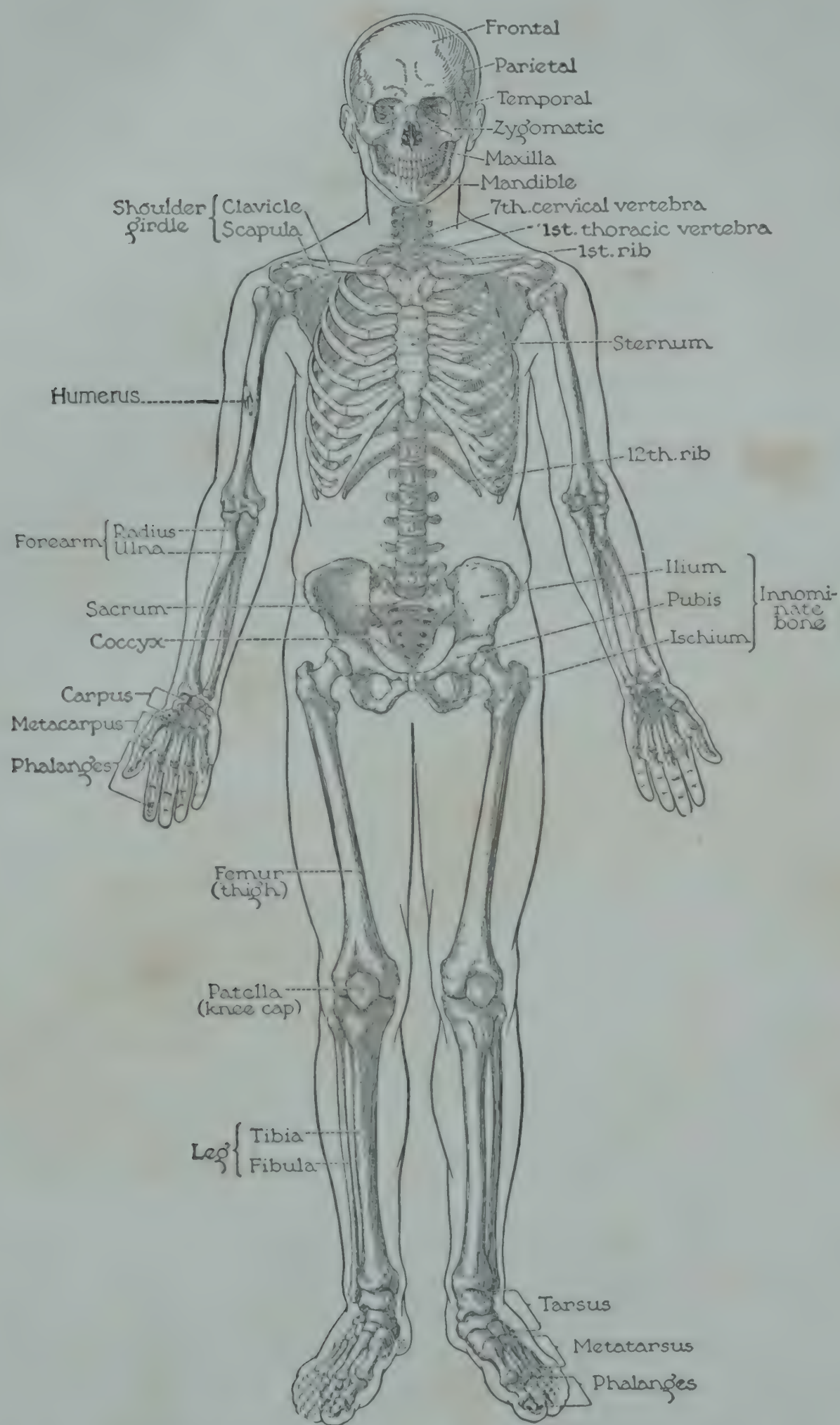


Fig. 18. The human skeleton. (Millard and King, Human Anatomy and Physiology.)



*thoracic vertebrae*, and five in the lumbar region (small of the back) known as *lumbar vertebrae*. The vertebrae become progressively larger from the cervical to the lumbar region and are all bound firmly together with ligaments.

Viewed from the side the vertebral column has four distinct, opposing curves. The cervical region is slightly curved with the convexity forward. In the thoracic region the convexity is to the back while the lumbar region is curved with the convexity forward. The sacrum is also curved, the convexity being to the back. This curvature gives resilience and spring to the spine, enabling it to absorb shocks which are sustained in walking and running, and thus protects the brain from being jarred. If one curve is increased or decreased other curves are affected also. A change in the tilt of the pelvic bones affects the curves of the spine. To maintain correct posture the curves of the spinal column must be kept in proper adjustment. The mechanical efficiency of the body is greatest when the opposing curves are kept shallow. The curves are then close to the axis of the spine. Viewed from the back the normal spine represents a straight line.

Closely associated with the skeleton are the skeletal muscles which hold the body frame in normal position, move the body in space and make possible the various positions of the body. The skeletal muscles form the great bulk of the body and are arranged in opposing groups, one to flex (bend) and the other to extend a joint. Proper alignment of body parts is maintained by these muscles which work in antagonism to each other.

The muscles are at rest only when opposing groups are relaxed. Due to the fact that the body is subject to the laws of gravity, opposing groups can be relaxed only when the parts of the body are in proper balance. When the body carriage is correct there is an equalized balance between antagonistic groups of muscles, while in faulty posture certain muscles are used in excess while others are used insufficiently. If a muscle gains an advantage over its opponent it tends to become shortened and stronger, and its opponent becomes longer and weaker. A departure from correct posture tends to increase due to the fact that it gives an advantage to a muscle or set of muscles which gain in strength at the expense of the opposing muscle or group of muscles.

It is evident that the body, being a jointed structure, can be held erect with a minimum of energy expenditure only if all of its parts are in proper alignment. It follows that efficient use can be made of the body only when its parts are properly balanced; the muscles then serve their normal function, i.e., to move bones that are in balanced relationship.

When the parts of the body are in equilibrium the weights of the head



and trunk are balanced upon the vertebral column and transferred through the pelvic girdle and legs to the feet. If any part of the body is out of its

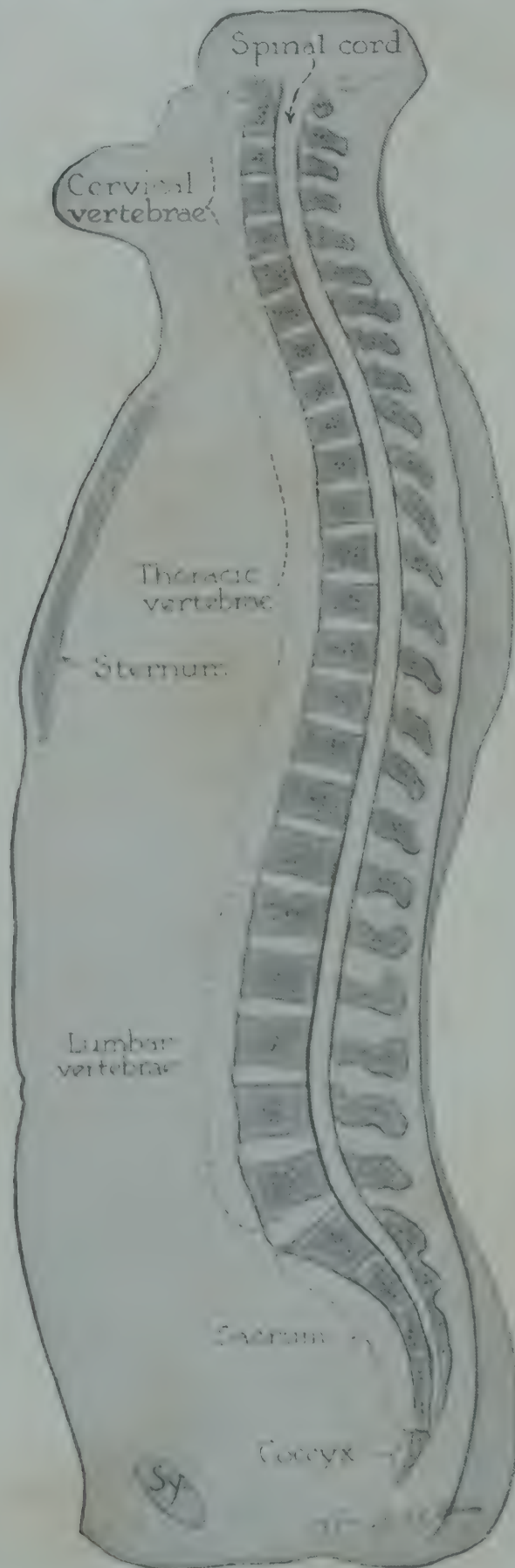


Fig. 19. The spinal column. (Courtesy of S. H. Camp and Company.)

natural alignment, more muscular energy needs to be expended to maintain the position of the body. Body energy used in this way is wasted energy. The weight of the body should be borne by the bones, not by the muscles.



In the abdominal region sheets of muscles extend from the lower margin of the ribs to the upper edge of the pelvis. These muscles constitute an important group for they form the abdominal wall, protect the viscera and assist in breathing. The stability of the back is maintained by numerous powerful muscles and tenacious ligaments. Another important group of muscles is the glutei or buttock muscles. They extend from the pelvis to the upper end of the femur and are important in maintaining the tilt of the pelvis.

### BALANCED CARRIAGE

In proper carriage the various parts of the body are so superimposed upon each other that the weight of the body is borne chiefly by the



Fig. 20. Vigorous play develops physical poise and grace. (Courtesy of Peddie School.)

skeleton without undue strain upon any group of muscles and with a minimum of energy expenditure. The position is one of comfort, not stiffness or tenseness.

**The Standing Position.** In the correct standing position the body is fully erect, the feet are slightly apart and the weight of the body slightly forward over the metatarsal bones. The vertebral column is fully



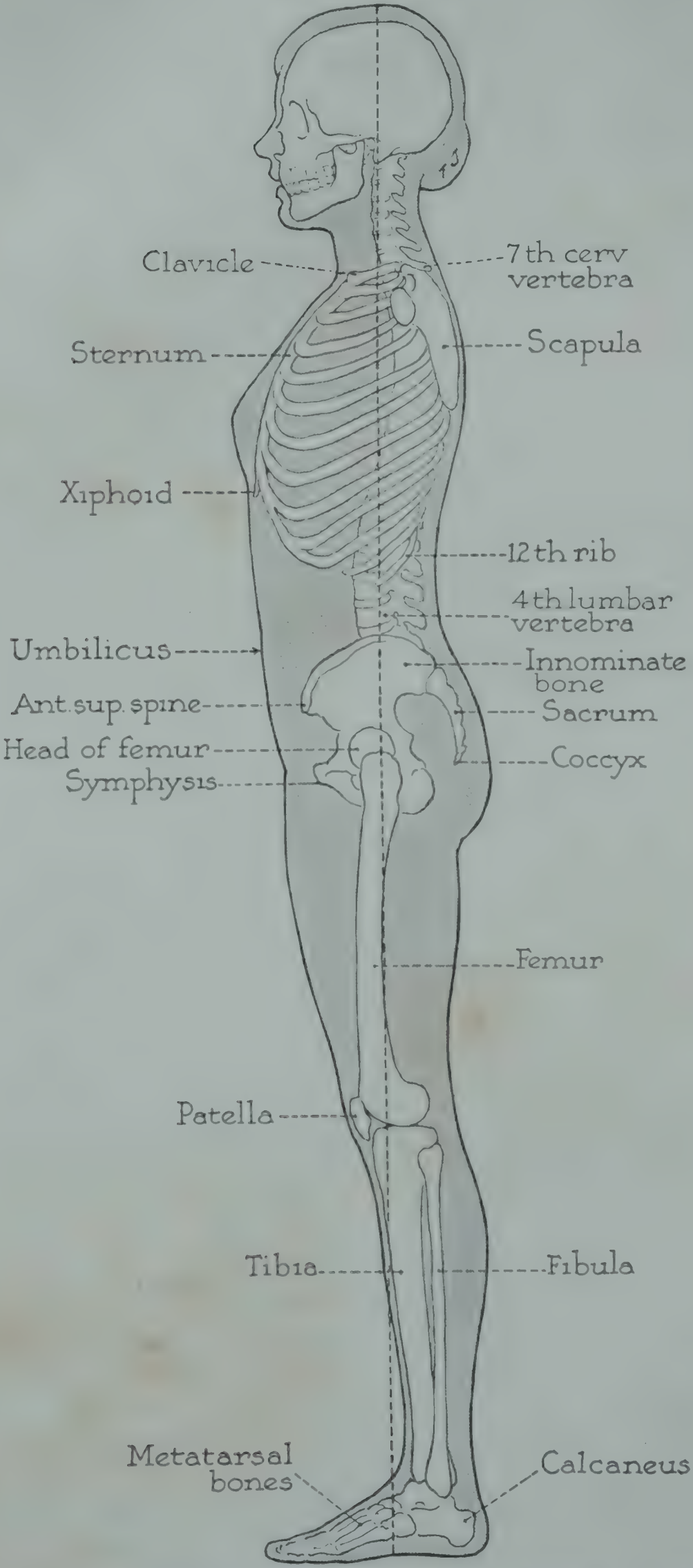


Fig 21. Fundamental standing position. (Courtesy of S. H. Camp & Company.)



extended. This reduces the spinal curves to a minimum and at the same time elevates the chest and the head, raises the viscera to the highest possible level and flattens the upper abdomen. The pelvis is correctly aligned; this is accomplished by contracting the buttock muscles and those of the lower abdomen. When standing correctly the body achieves its full height. This position is not one that is continuously held but is a basic position from which constant changes are made.

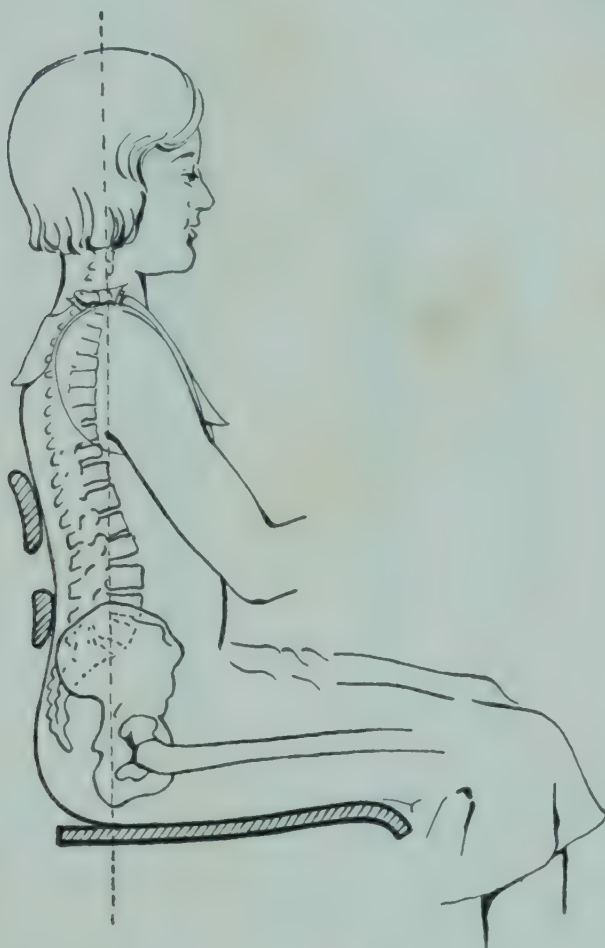


Fig. 22. In the correct sitting position the body weight is balanced about the spine which maintains its normal curves, the chest is lifted and expanded and the abdominal muscles are taut. (Courtesy of American Seating Company.)

In the correct standing position an imaginary plumb line dropped from in front of the ear, viewing the body from the side, should pass through the middle of the shoulder, the center of the hip, the knee and the forward part of the foot just anterior to the ankle. This line will parallel the apparent axes of the head, neck and trunk of the body. In an incorrect position the axes of the main body segments form a zigzag line. In walking the general position of the body should be the same as in standing. Movement should start at the hips, not at the knees. The weight should be transferred forward toward the outer border of the feet.

**The Sitting Posture.** Good sitting habits are especially important in modern life since most people spend many hours each day in the sitting



position. In the basic sitting position the vertebral column is fully extended, as in the standing position. The buttock is well back in the chair, the trunk and head are centered over the pelvis, the chest is in a raised position, the shoulders are level but not shrugged upward, and the hips and knees are flexed at right angles. In this position the thighs as well as the buttock support the weight of the body.

When inclination of the body forward is necessary, it should be accomplished by pivoting at the hip joint, not at the waistline. The chair should be of sufficient height so that the arms may rest easily on the table

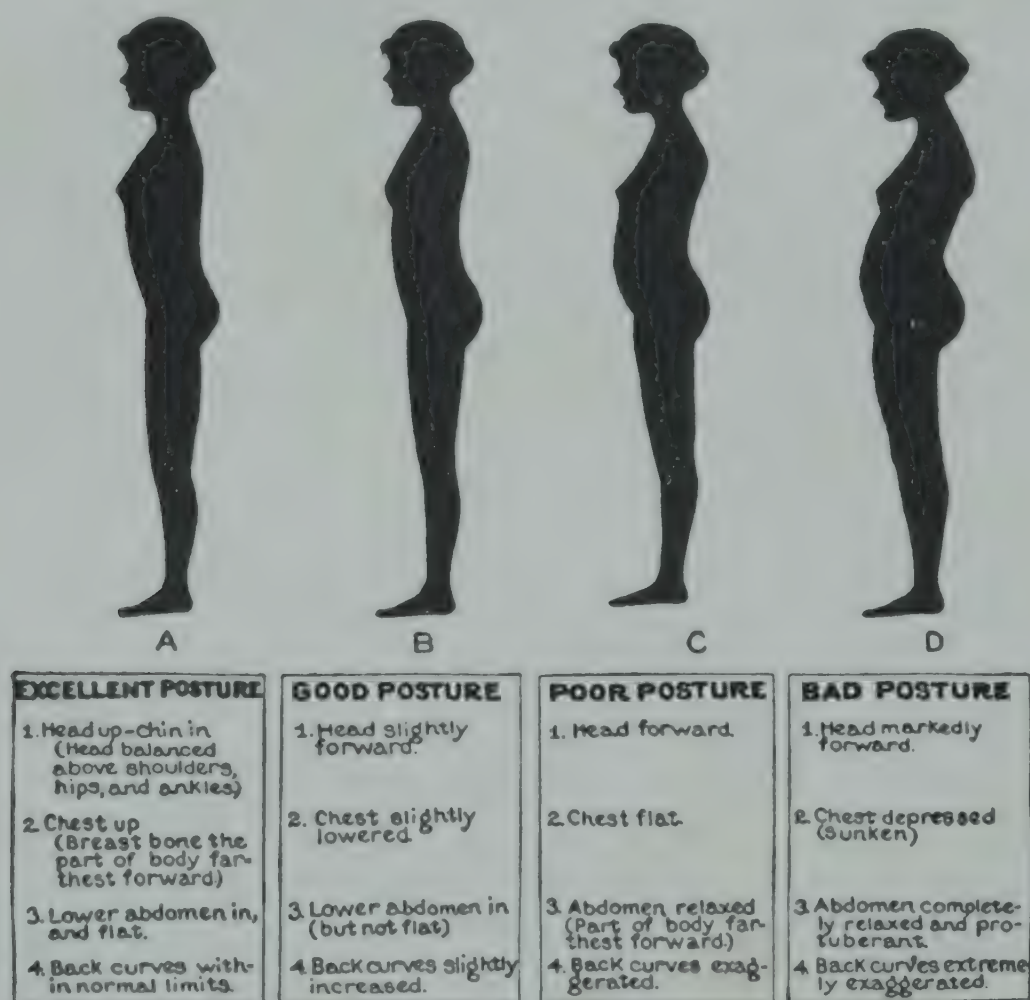


Fig. 23. Prevailing postural types. (Intermediate-type girls.) (Courtesy of Children's Bureau, U. S. Department of Labor.)

without raising the shoulders. Correct sitting is a graceful, comfortable, restful position that can be maintained with least effort; it is a position that increases the efficiency of sedentary workers.

In the resting position the body may recline backward somewhat without assuming a slouching position. When resting in an easy chair a position not in harmony with the position just described may be restful and may be assumed for brief periods of time without harm. Such sitting, however, should not become habitual.

In good body carriage the chest remains elevated and breathing is due



chiefly to the action of the diaphragm. This type of breathing is called *abdominal breathing* and involves the upper abdomen, the lower abdomen being held taut. Breathing caused by the elevation and lowering of the ribs is called *costal breathing*.

### PREVAILING POSTURAL TYPES

It has been found that modern human beings can be classified, in regard to physical bearing, into four chief types, ranging from excellent to

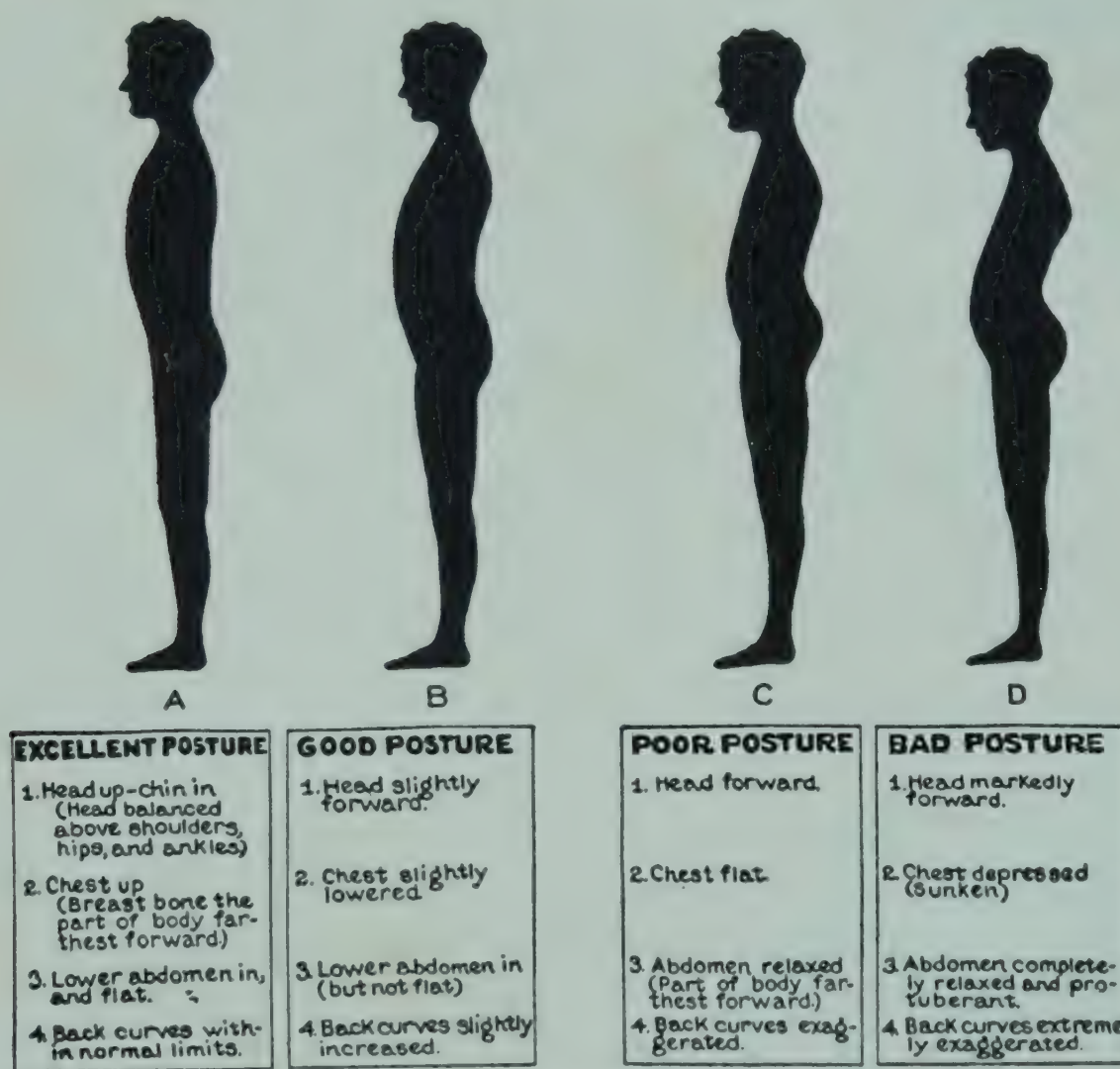


Fig. 24. Prevailing postural types. (Intermediate-type boys). (Courtesy of Children's Bureau, U. S. Department of Labor.)

inferior. Figure 23 shows these types in profile for intermediate-type girls and Figure 24 for intermediate-type boys. Each type is analyzed on the basis of four factors, namely, the position of the head, position of the chest, contour of the abdomen and the curves of the spine.

### FAULTY SITTING POSITIONS

A faulty position commonly found in students and others sitting at tables or desks is a slumped position resulting in a flattened chest, rounded



shoulders, protrusion of the abdomen and obliteration of the natural curves of the spine. A common faulty classroom position is sliding forward in the seat of the chair with the shoulders resting against the back of the chair. In this slouched position the back curves outward, the pelvis is tilted, the thorax is cramped and pressure is exerted on the pelvic and abdominal organs. Incorrect sitting produces fatigue rapidly and if assumed for any length of time is detrimental to health.

### EFFECTS OF FAULTY POSTURE

Errors in body mechanics with the resulting pressure upon, and displacement of, visceral organs impairs their functioning, thus reducing



Fig. 25. In a slumped sitting position the pelvis tilts backward, the normal curves of the spine are obliterated, the chest is compressed and the abdominal wall is loose and flabby. (Courtesy of American Seating Company.)

physical fitness. Much evidence is available indicating postural involvement in many organic abnormalities.

Incorrect posture may interfere with the functioning of the diaphragm, causing it to sag downward, thus seriously limiting the amplitude of its movements. The movements of the diaphragm are important not only in breathing but also in maintaining adequate circulation of the blood. Limiting the action of the diaphragm affects the flow of blood in the



large veins near the heart because the diaphragm does not then produce the necessary pumping action to cause a rapid return of the blood to the heart. Circulation is impeded and congestion of blood occurs in the large thoracic and abdominal veins. The sagging of the diaphragm also displaces the heart by pulling it downward, thus subjecting it to strain and injury. This condition is referred to as "dropped heart."

The lowering of the diaphragm also displaces the abdominal organs by forcing them downward and forward. The membrane (mesentery) which attaches the intestines to the body wall may become stretched. This may cause circulatory disturbances and faulty nerve impulses since the mesentery contains blood vessels and nerves. Digestive disturbances and constipation are frequent results of this condition. The crowding downward of the abdominal viscera exerts pressure on the pelvic organs and hampers them in their functions. In women it may cause displacement of the uterus, ovaries or other pelvic organs. Women whose posture is excellent are usually free from periodic pelvic pain or weakness.

Long continued improper posture may cause alterations in the shapes of certain vertebrae, resulting in a permanent accentuation of a normal curvature or the development of abnormal curves.

A common and troublesome fault of posture is an increase of the lumbar curve. This condition, known as *lordosis* or "sway-back," is accompanied by a forward and downward tilt of the pelvic organs and protrusion of the abdomen. In this position the last lumbar vertebra rests at too sharp an angle on the sacrum, producing a weak joint at this place. This results in a general strain on the muscles and ligaments of the lumbar region, producing pain. Faulty posture is a frequent cause of low back pain, which is a common ailment of modern man.

A common structural change in the spinal column is *kyphosis* or "round back," which may result from a stooping posture habitually maintained. In this condition the thoracic curve is increased, the shoulders and head are bent forward and the chest is flat. Lateral curvature of the spine, known as *scoliosis*, is a condition in which the spine deviates sideways. It usually starts as a simple functional lateral deviation. If untreated it usually progresses to a double curve and finally the vertebrae and ribs become permanently altered in shape. An individual may have both *kyphosis* and *lordosis* at the same time.

### CAUSES OF FAULTY POSTURE

There are many causes of poor posture. Most cases are due merely to failure to establish practices of good body mechanics. Other causes



are (1) inherited structural irregularities; (2) malnutrition, which brings with it insufficient muscular power properly to balance the body against the force of gravity; (3) tight or constricting garments worn during preadolescent and adolescent ages; (4) incorrect footwear, especially shoes with very high heels; (5) insufficient physical activity which results in muscular insufficiency; (6) lack of a wholesome mental attitude toward life; (7) occupations which confine the body in improper posture for many hours a day.

### ATTAINING GOOD POSTURE

It is possible for nearly everyone to attain good posture. It is necessary first to acquire a postural sense so that one will become aware immediately of any deviations from correct posture. The next step is to develop a conscious technic of correct body carriage. This is easy to do if the attention is centered on two main points, (1) fully extending the spine and (2) rolling the hips back.

The spinal axis must be kept long so that the curves will be shallow and the buttock muscles must be contracted sufficiently to rotate the pelvis into proper position, i.e., roll the hips back. Extending the spinal column elevates the chest and head, and flattens the upper abdomen. Rolling the hips back flattens the lower abdomen and by reducing the lumbar curve assists in fully extending the spine.

Mental attitude is also a factor in the mechanical use of the body. A cheerful, hopeful attitude is usually reflected in body carriage. A good state of mind tends to produce proper use of the muscles and helps to give buoyancy to one's step and confidence to one's bearing. A person who has attained good posture has mastered an accomplishment that is a distinct health asset.

### POSTURE TESTS

**Plumb Line Test.** Take a cord with a weight attached and suspend it at the side of the individual (standing in his usual posture) so that it will parallel an imaginary vertical line dropped from in front of the ear. This imaginary line, when the posture is correct, will pass through the middle of the shoulder, hip, knee, and the forward part of the foot just anterior to the ankle. In other words, the cord will parallel the axis of the body when the posture is correct. If the posture is incorrect, the axes of the head, neck and trunk will not form a continuous straight line.

**Front Wall Test.** The individual faces the wall and touches it with his toes. The thorax should touch the wall and the nose should be about



an inch away from it. The thighs should be not more than the width of a hand from the wall.

**Back Wall Test.** The individual stands with the heels, calves, buttock, shoulders and head against the wall. A hand is then placed in the space between the wall and the lumbar curve. The lower back is then pressed against the hand. In this position the posture is correct and the individual may walk away from the wall in this posture.

**Silhouette Method.** This involves taking pictures, or silhouettes, of the individual being tested and comparing them with a series of silhouettes that show different degrees of variation from normal. If the posture is not correct the silhouette portrays just what postural defects are present.

### MAKING CORRECT POSTURE A HABIT

In correcting poor posture it is necessary to overcome a faulty habit and replace it with a good habit. The cure for incorrect posture is training in correct posture. After one has learned what good body carriage is one should practice assuming good posture at all times in all of one's daily tasks until the habit is well established. Patience and perseverance are essential. It is necessary to tell oneself repeatedly to straighten up, to sit erect and to stand erect to one's full height. Posture consciousness must become a part of the individual's life until correct habits of body carriage have been formed.

### POSTURE EXERCISES<sup>1</sup>

In some cases of incorrect posture, exercises are needed before correct posture can be attained. In all cases of incorrect posture exercises are of value unless the poor posture is due to an organic defect in which case a physician should be consulted. The exercises described below are of value also if used as daily exercises for the general health of the body.

#### Exercise I. Standing Against Wall; Abdominal Retraction

1. Stand with back against the wall, keeping the heels 4 in. from the wall.
2. Let the buttock, shoulders and head touch the wall.
3. Flatten the lower back against the wall by pulling in the abdominal muscles while strongly contracting the buttock muscles.
4. Relax and repeat the exercise.

Note: This exercise causes a "rolling down" of the buttock and will give the individual conscious control of the abdominal and buttock muscles. This is one of the most important posture exercises and should be repeated often.

<sup>1</sup> These exercises are based on exercises on pages 27 to 30 of "Posture Exercises," by Dr. Armin Klein & Leah C. Thomas (Publication No. 165, Children's Bureau, U. S. Department of Labor.) Permission to restate them has been granted by the Children's Bureau with the approval of Dr. Klein.



**Exercise II. Standing with Hands Back of Neck; Abdominal Retraction**

1. Place the hands back of the neck so that the finger tips touch.
2. In this position repeat Exercise I.

Note: The position of the arms in this exercise raises the ribs. In this position it is more difficult to flatten the lower back. This exercise properly performed should develop the ability to flatten the back without difficulty when in the normal standing position.

**Exercise III. Sitting in the Correct Position**

1. Draw the chin in and back and thus raise the chest.
2. Pull in the lower abdominal muscles and at the same time roll down the lower back in the same way as in Exercise I.
3. Relax the abdominal muscles, allowing the lower back curve to return.
4. Repeat.

**Exercise IV. Correct Diaphragmatic Breathing in the Sitting Position**

1. Raise the chest by sitting erect with head well back and chin in.
2. Hold the chest high and inhale.
3. Hold the chest high and exhale.

Note: It may be helpful to place one hand on the chest during this exercise. The hand must not move up or down during breathing. If this exercise is performed properly the habit of correct diaphragmatic breathing can be easily acquired.

**Exercise V. Standing in the Correct Position**

1. Stand with hands at the sides.
2. Flatten the curve in the lower back by retracting the lower abdominal muscles and contracting the buttock muscles.
3. Maintaining the above position, raise the head and pull in the chin.
4. Relax and repeat. Flatten the back on count one, raise the head and pull in the chin on count two. Relax on count three.

**Exercise VI. Rib Stretching in Sitting Position**

1. Place the hands on head and flatten the lower back against back of chair.
2. Raise left shoulder upward so that a strong pull can be felt from the lowest ribs.
3. Repeat, raising the right shoulder instead of the left.
4. Raise both shoulders at the same time.

Note: Do not hold the breath during this exercise. This exercise elevates and widens the chest and is conducive to a deeper and freer action of the diaphragm. It also increases the flexibility of the chest.

**Exercise VII. Sitting with Trunk Bent Forward**

1. Assume the correct sitting position in a chair.
2. Bend the trunk forward from the hips as if the spine were not flexible but a straight rod.

Note: This is the correct position of the trunk when working at a desk or table.



**Exercise VIII. Sitting with Hands on Head; Abdominal Retraction**

1. Lean against the back of the chair with hands clasped on top of the head.
2. Pull in the lower abdominal muscles and flatten the lower back (count one).
3. Relax the abdominal muscles (count two).
4. Repeat ten times without lowering chest or ribs.

**Exercise IX. Rib Stretching in Standing Position**

1. With hands clasped on head raise the left shoulder, stretching upward, so that a strong pull can be felt on the lowest ribs.
2. Repeat stretch on right side.
3. Stretch both sides at same time.

Note: This exercise gives a strong upward pull on the ribs and raises the diaphragm, thus making room for the organs elevated by the retraction of the lower abdominal muscles.

**Exercise X. Tiptoe Walk**

Walk on tiptoe with the arms raised forward and upward to form an angle of 45 degrees with the axis of the body.

Note: This exercise raises the diaphragm and brings into play the balancing mechanism of the back muscles in the lumbar region.

**QUESTIONS FOR CLASS DISCUSSION**

1. Explain the meaning of the term "posture."
2. Discuss the advantages of good posture.
3. Name the chief parts of the skeleton.
4. Describe the spinal column.
5. Explain the role that the skeleton and muscles play in body mechanics.
6. How does the structure of the spinal column, including its curves, aid the body mechanically?
7. Describe the correct upright position of the body.
8. Why should one sit correctly? Describe the correct sitting position when (a) at rest and (b) working at a desk.
9. Describe the four postural types found among human beings.
10. To which type do you belong? If you are not an A, how may you enter this group?
11. Describe some common faulty sitting positions.
12. Discuss the effects of faulty posture.
13. What is kyphosis? Lordosis? Scoliosis?
14. What are the causes of faulty posture?
15. State specifically what one must do to get the body into proper alignment.
16. Explain: (1) the plumb line test, (2) front wall test, (3) back wall test, (4) silhouette method.

**TOPICS FOR ORAL OR WRITTEN REPORTS**

1. Make a careful survey of the members of your class or some other group, taking note of their body carriage. Tabulate your findings as accurately as you can.
2. What arguments would you use to convince a person with faulty posture to



attempt to improve his body carriage? What specific directions would you give the person to get his body into proper alignment?

3. Investigate body carriage in animals. Do they have any postural difficulties? Explain.

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## CHAPTER 9

### *The Feet and Their Care*



MAN's upright position throws the entire weight of the body on two feet. Although good feet are essential to normal living, the feet of human beings are often abused until they become weak and deformed. Defective feet cause inconvenience and suffering and interfere with the endurance and efficiency of the individual. Physical fitness is impossible with feet low in functional capacity. Available data show that defective feet are among the most common ailments of modern life. It has been estimated that about 70 per cent of our people have trouble with their feet and it has been found that a large percentage wear shoes of improper fit or design. Foot troubles can be, for the most part, prevented. To safeguard one's feet one must walk correctly, keep the foot and leg muscles strong, maintain good body carriage and wear shoes of proper design and fit.

The normal foot is sufficiently strong to bear the weight of the body properly and possesses sufficient flexibility to bend easily in walking, running and jumping. The arches are in good condition, the toes are straight, the foot is free from corns, calluses, bunions and pain.

#### FOOT STRUCTURE

The normal human foot is a strong, flexible mechanism consisting of twenty-six bones of various shapes and sizes, firmly bound together by ligaments and supported by tendons and muscles. The bones are arranged in three sets, (1) seven *tarsal* bones irregularly shaped compose the ankle and heel; (2) five long bones known as *metatarsals*; and (3) fourteen *phalanges* which make up the toes (two in the large toe and three in each of the others). The arrangement of the bones is such that two primary arches are formed, the *longitudinal arch* and the *metatarsal arch*. The arched formation of the foot is maintained by the shape of the bones, by appropriately placed ligaments underneath the arch, and by muscles and their tendons. This construction gives flexibility to the foot as well as the needed strength and stability to bear the weight of the body efficiently. The arches serve to absorb the shocks and jars resulting from walking, running and leaping.



The longitudinal arch extends from the heel bone (calcaneus) to the distal ends of the metatarsal bones, that is, the ball of the foot. The inner side of the arch is higher than the outer side. The metatarsal arch, also

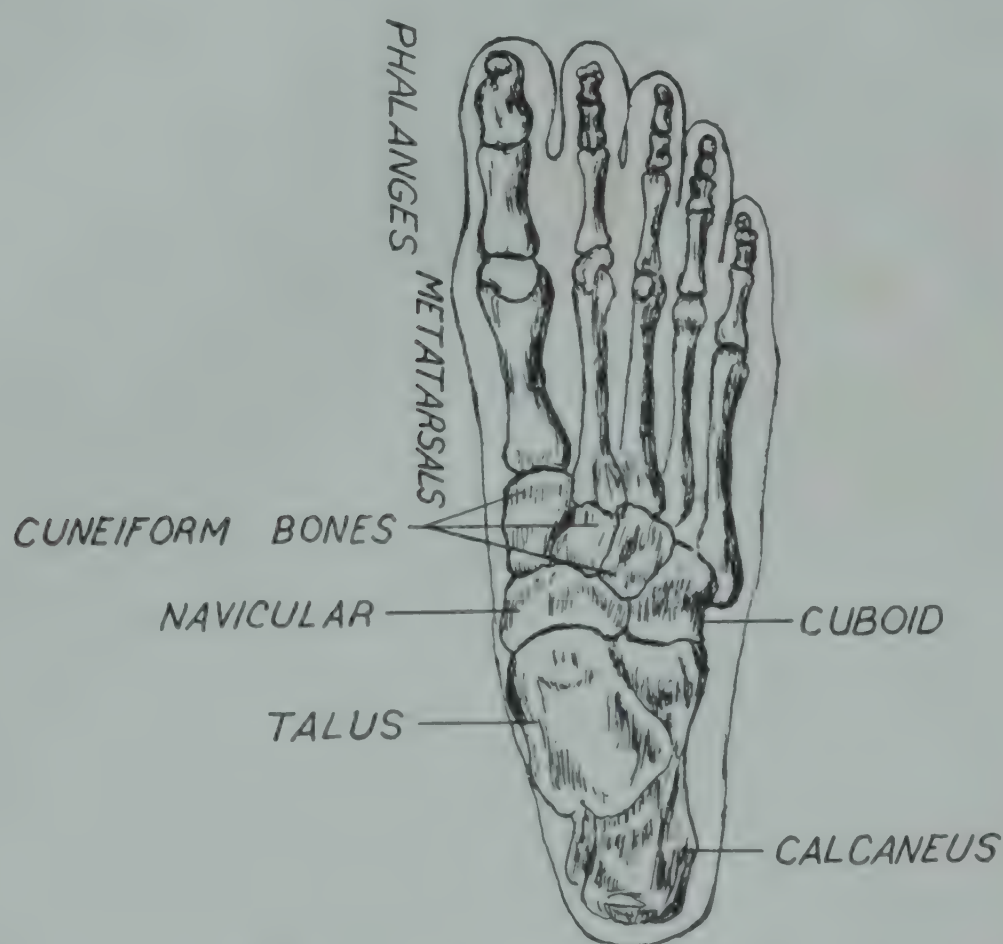


Fig. 26. Bones of the human foot.

known as the anterior arch, extends from side to side just back of the toes from the first to the fifth metatarsal bones. In the normal foot these arches are kept in correct alignment.

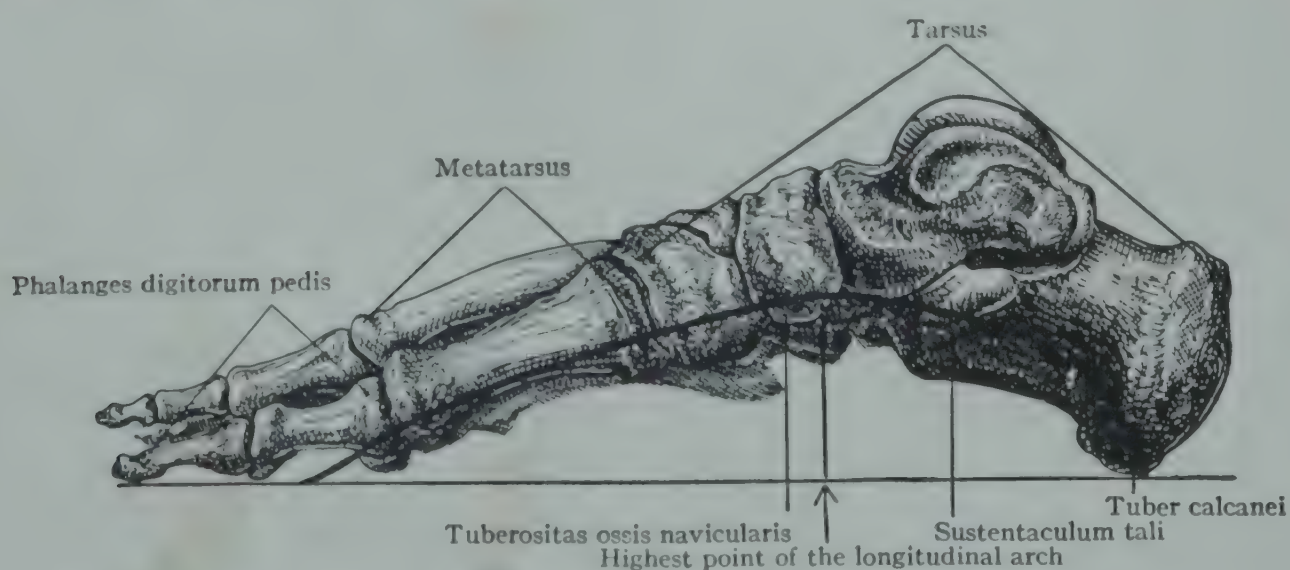


Fig. 27. Longitudinal arch of the foot. (Callander, Surgical Anatomy.)

The muscles that give support to the arches of the foot are not only those that lie within the foot itself but include certain muscles in the



lower leg. The propelling force in locomotion is provided by the large muscles in the calf of the leg. These leg muscles are attached to the foot bones by means of long tendons. The muscles in the foot move the toes and guide the various directional movements of the foot.

Nature introduced engineering principles into the anatomy and mechanics of the foot in that an arched structure possesses great strength and distributes weight uniformly. The foot may be visualized as a tripod with three points of support: (1) the heel, (2) the base of the large toe and (3) the base of the little toe. In the standing position 60 per cent of the weight of the body is distributed to the heels, 30 per cent to the outer side, and 10 per cent to the inner side of the feet.

In some individuals the longitudinal arch is too high. This is a hereditary trait and such a foot is usually inefficient unless especially trained. Some persons, on the other hand, have by inheritance very low longitudinal arches but nevertheless have strong efficient feet. The efficiency of feet cannot be judged by the height of the arches.

### THE FOOT IN ACTION

It has been advocated by many who have made a study of the foot that the position of the feet in standing and walking should be parallel with the toes pointing straight ahead. D. J. Morton<sup>1</sup> has attempted to determine the normal angle of gait by examining 379 American college students and 147 African natives who had never worn shoes. He concluded that the parallel position was not normal for either group for he found that the average angle of the feet in walking was about  $7\frac{1}{2}$  degrees (15 degrees between the two feet), with close agreement in the two groups. He found also that the angle tends to vary somewhat with each step. If his findings may be considered normal, then a mild degree of out-toeing is the natural position of the feet in walking. A wide angle of gait, however, may disturb the distribution of body weight and be harmful, especially to weak feet.

The toes play a role in walking; they give the final forward push in every step one takes. The foot loses much of its mechanical efficiency if the toes are not used to propel the body.

### DEFECTS OF THE FEET

Modern conditions of living, which require the use of the feet on hard pavements and floors for which they are not adapted by nature, are very likely to cause disordered functioning of the feet unless the individual dons correct footwear and cultivates the proper mechanical use of the

<sup>1</sup> Morton, D. J., *The Human Foot*, Columbia University Press, 1935.



feet. Improper use of the feet, or the wearing of improperly designed or ill-fitting shoes, may bring about an improper distribution of body weight over the metatarsal bones, resulting in weakening of the musculature, tendons and ligaments of the feet.

**Disorders of the Longitudinal Arch.** A mild degree of longitudinal arch weakness is known as *weak-foot* while a more advanced type is spoken of as *pronated foot* or *fallen arches*. In the condition known as weak-foot the arch sags or flattens when bearing the weight of the body. When the weight is removed it regains its normal shape. This condition is due to loss of muscular tone and strength in the foot and leg muscles and weakening of the supporting ligaments. In some persons the cause may be attributed to the fact that the first metatarsal is shorter than the second metatarsal. In this case, which is an inherited condition, the first metatarsal does not support its share of body weight. In the condition known as pronated foot the bones of the arch slip out of place and the ankle rolls toward the inner border of the foot, causing the weight to fall on the inner part of the longitudinal arch. This is accompanied by strain in the muscles of the foot and leg.

To bring the feet back to normal condition the muscles which support the arches must be strengthened by means of suitable, systematic exercises. Arch supports should not be used unless advised by a physician. Because they serve as supports they weaken the muscles instead of strengthening them. Shoes of proper design that permit correct use of the feet must be worn and the habit of using the feet correctly must be acquired.

**Metatarsalgia.** Metatarsal arch strain is known as *metatarsalgia*. It is characterized by callus formation under the ball of the foot, generally at the base of the second and third toes. Excruciating pain may occur in the region of the arch and the outer toes. Women suffer from this condition more frequently than men, due chiefly to the wearing of high-heeled shoes which distort the foot and throw an excessive amount of weight on the metatarsal arch.

**Bunion.** In this condition the large toe deviates outward toward the other toes. This deviation usually is accompanied by inflammation and enlargement of the joint between the large toe and the foot. The enlargement of this joint constitutes a bunion. The pressure of the shoe on the bunion give rise to the formation of a tender callus. Bunions are caused by wearing short or pointed shoes. The correction of this condition frequently requires orthopedic surgery.

**Corns.** Corns are the most common foot ailments. A corn is a thickened area of skin resulting from the wearing of ill-fitting shoes which pinch or



cause friction. Corns are painful because they cause pressure on nerves in the dermis of the skin. There are two kinds of corns, hard and soft. Hard corns occur on external surfaces while soft corns occur between the toes on the bony prominences. Primitive peoples who do not wear shoes do not have corns. To prevent corns, shoes of proper shape and fit must be worn. Paring corns with a knife or razor blade involves the risk of cutting the adjacent skin, which may lead to serious infection.

**Ingrown Toenails.** This condition is caused by pressure exerted by ill-fitting shoes against the sides of the toes. The soft parts are forced against the nails and become inflamed, swollen and painful. Ingrown toenails are quite prevalent and occur most commonly on the large toe. This condition can be prevented by wearing hosiery of correct size and shoes of proper shape and fit. Proper trimming of the toenails is also important. The nails should be cut flush with the fleshy part of the toe, and the corners should not be cut round but should be permitted to project over the nail bed.

**“Athlete’s Foot.”** Ringworm of the feet or “athlete’s foot” is an infection of the skin between the toes and the area under the toes. Blister-like and scaly sores occur, the skin becomes soft and peels off in the form of shreds. Although the infection is widespread only a small percentage of infected individuals have the disease in serious form. The causative agent is a microscopic fungus (moldlike organism) which grows just beneath the skin. Proper treatment may cause the symptoms to disappear but the fungi in the skin are not necessarily destroyed; they may become active again, especially in warm weather when perspiration encourages their growth. The disease is contracted chiefly by walking with bare feet on the floors of gymnasium locker rooms, shower bath rooms, and swimming pool runways where others have walked bare-footed.

## FOOT EXERCISES

### Exercise I. Outward Roll

1. With shoes and stockings removed stand with the feet about 2 in. apart.
2. Roll the feet outward so that the weight of the body is shifted to the outer borders of the feet.
3. Let the feet roll back slowly but keep the inner part of the foot clear of the floor.
4. Repeat the above movements ten times and gradually increase to fifty times twice daily.

### Exercise II. Rising on Toes

1. Stand with toes together and the heels about 12 in. apart.
2. Rise slowly on the toes.



3. Return to original position.
4. Repeat ten times and gradually increase to fifty times twice daily.

### **Exercise III. Walking on Outer Borders of Feet**

1. Walk about the room with the weight of the body on the outer borders of the feet. Do this for one or two minutes at a time.
2. Walk with the toes turned in and the weight of the body on the outer borders of the feet.

### **Exercise IV. Walking on Toes**

1. Walk about the room on tiptoe with the heels turned out. Do this for one or two minutes at a time
2. Gradually increase the length of time for this exercise.

### **Exercise V. Flexing and Spreading the Toes**

1. In a sitting position rest the heels on the floor and flex the toes.
2. Spread the toes as far as possible.
3. Return to original position.
4. Repeat ten to twenty-five times with each foot.

### **Exercise VI. Foot Gripping**

1. Walk about the room with the feet parallel and pull the toes in and under.
2. Repeat fifteen to thirty times.

### **Exercise VII. Foot Circling**

1. In a sitting position cross the right knee over the left knee.
2. Describe a circle by bending the right foot downward, inward, upward and outward.
3. Alternate left and right foot.
4. Repeat twenty to forty times.

### **Exercise VIII. Grasping with Toes**

1. Pick up marbles of various sizes by curling the toes around them.
2. Pick up a pencil with the toes and take as many steps as possible without dropping it.
3. Pick up a golf ball with one foot and transfer it to the other foot.
4. Stand on a thick book with the toes extending over the edge.
5. Bend the toes up and down over the edge of the book and attempt to grip the side of the book, keeping the weight on the outer border of the feet.
6. Repeat, alternately contracting and relaxing the muscles of the feet.

To be of value in strengthening the feet these exercises must be performed regularly and often over a long period of time. Exercises that strengthen the musculature of the entire body are also of value in strengthening the feet. Improvement of body posture is important also. When the posture of the body improves foot posture generally improves also. Exercises such as running, jumping, dancing, swimming, and tennis are of value in strengthening the feet. Walking is in many cases the only exercise that weak feet need to bring them back into good condition.

## **HYGIENIC FOOTWEAR**

If the feet are to function efficiently proper footwear is necessary. Shoes must be adapted for use on hard surfaces which do not absorb the shock



of impact as does the resilient earth upon which nature intended us to walk. Foot disorders are frequently due to poorly designed and improperly fitted shoes.

The shoe should conform to the normal shape of the foot. It should be of sufficient length so that the toes can be fully extended and of sufficient breadth to allow the toes to be flexed while standing. It should not

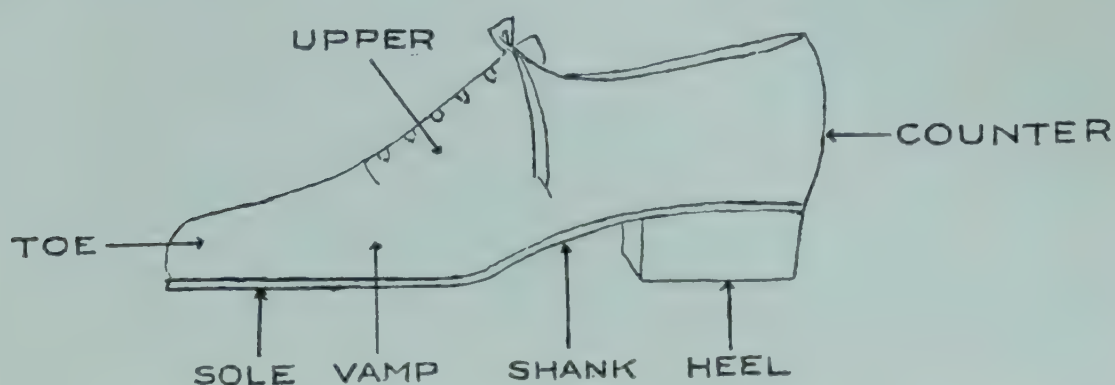


Fig. 28. External parts of a shoe.

be tight across the ball of the foot. A well-designed shoe does not interfere appreciably with the normal muscle action of the foot. Interference with the free movement of the toes weakens the metatarsal arch as well as the foot in general. A low vamp tends to flatten the metatarsal arch. If the shoe fits snugly when the foot is not bearing weight it will be too tight when the weight of the body is placed on the foot. The sole of the shoe



Fig. 29. X-ray print of foot in shoe of good design. (Courtesy of Antioch College.)

should be flat and moderately thick and firm so that it will not curl up at the sides. It should, however, be fairly flexible and not stiff.

The heel should be broad and not more than an inch and a quarter, or at most an inch and a half, in height. Shoes with no heel elevation are unsatisfactory for use on hard floors and sidewalks. Rubber heels are advisable since they absorb the shock of impact on hard surfaces better



than do leather heels. Shoes with high heels throw most of the weight of the body upon the toes. This places a strain on the metatarsal arch. High heels prevent straightening of the knees in walking and throw the body out of proper alignment, causing the pelvis to tilt forward; this places



Fig. 30. X-ray print of foot in poorly designed shoe. (Courtesy of Antioch College.)

pressure upon the pelvic and abdominal organs. The result is an awkward and mechanically incorrect carriage of the body. Correct posture is difficult to attain if the heels are very high. In many cases high heels give rise

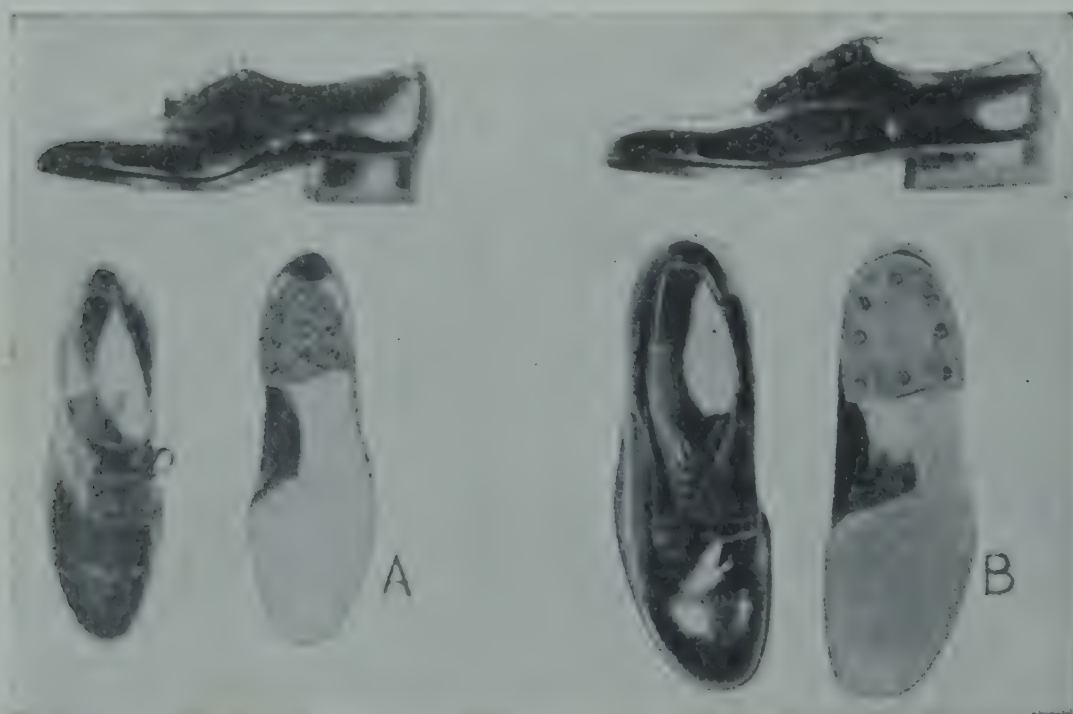


Fig. 31. Types of shoes considered correct for the preservation of good feet. A, Woman's shoe; B, man's shoe. (Courtesy of Hygeia, the Health Magazine.)

to a protruding abdomen. If high-heeled shoes are worn continuously the tendon of Achilles becomes shortened. The continuous use of high-heeled shoes is an important cause of foot disorder but if worn only during evening hours or on special occasions by a person with normal feet, high-



heeled shoes will do no harm. A person accustomed to high heels should not change suddenly to low heels. The change should be made gradually over a period of months.

The shoes should be so designed that when the inner side is placed against a straight edge the shoe will touch the edge along the entire heel and along all but the last inch or so of the sole. This is spoken of as a "straight inside line." In many shoes the inner margin turns outward from the ball to the tip. This type of shoe causes the large toe to be pushed outward.

A low shoe is preferable to a high shoe for it permits the ankle to move more freely and also permits better ventilation of the feet. The oxford type is usually preferable to the pump or slipper type since a better fit can be obtained in this type.

### **SHOE-FITTING FLUOROSCOPES**

Shoe-fitting devices which are a type of fluoroscope are used in many shoe stores as an aid in the proper fitting of shoes. A fluoroscope is a mechanism used for examining body structures by means of x-rays. It contains a fluorescent screen covered with calcium tungstate upon which an x-ray image is formed. Since a shoe-fitting fluoroscope emits x-rays it must be used with caution. Many of these devices have a high x-ray intensity, above the accepted tolerance dose. Even those that have an automatic cutout, limiting the exposure to one-fifth or one-half minute may be dangerous because of repetition of exposure in trying on many pairs of shoes. Although proper shoe-fitting is important, the use of the x-ray machine by those who do not have a thorough scientific training in its use is not without danger.

### **HEALTH PRACTICES TO BE ACQUIRED**

To maintain the functional activity of the feet the following health practices are suggested:

1. Daily exercise that will keep the musculature of the feet strong.
2. Walking with the weight properly distributed over the feet.
3. Standing with the feet pointing straight ahead and the weight of the body on the middle of the feet.
4. Acquiring an appreciation of shoes which are hygienically correct.
5. Wearing shoes of correct design and fit.
6. Using the toes to give the final forward push as the foot leaves the floor.
7. Taking precautions to prevent ringworm of the feet.



**QUESTIONS FOR CLASS DISCUSSION**

1. Explain the structure of the human foot.
2. How are the bones of the foot held in place?
3. Describe the (1) longitudinal arch, (2) metatarsal arch.
4. What purpose do the arches serve?
5. How is body weight distributed over the feet?
6. What role do the toes play in walking?
7. Discuss the disorders of the longitudinal arch.
8. What are the remedial measures for weak and pronated feet?
9. What is metatarsalgia?
10. What is a bunion? How is it caused?
11. What are corns? Why are corns an indication of improper shoes?
12. How may ingrown nails be prevented?
13. What is "athlete's foot"? How may it be prevented?
14. Give the specifications of a good shoe.
15. Why should not the shoe interfere with the free movement of the toes?
16. What harm may a low vamp do?
17. Why is the height of the heel important?
18. Why should the inside line of the shoe be straight?
19. Why are oxfords preferable to the pump or slipper type of shoe?
20. Are you properly shod? If not, in what ways do your shoes deviate from the ideal?

**TOPICS FOR ORAL OR WRITTEN REPORTS**

1. Discuss fully how defective feet might handicap your plans for the future.
2. What arguments would you use to convince a person whose choice of shoes is not in line with his health interests, that he should change to a shoe that possesses the proper specifications?

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## CHAPTER 10

### *Care of the Skin in Relation to Health*



THE health of the skin is very intimately associated with the general health of the body. The texture and tone of the skin determine to a large degree the attractiveness of the individual. The skin is not merely a protective covering but one of the most important organs of the human body. It comprises a surface of fifteen to twenty square feet and requires proper care and attention to enable it to carry on its various physiologic functions efficiently. The skin has been called “the mirror of the system” because changes in bodily health are so often reflected in it. This is particularly true of the complexion.

#### STRUCTURE OF THE SKIN

The skin is a tough, flexible organ that varies in thickness from 0.5 to 4.0 mm. and consists of two major layers, a thin outer layer known as the *epidermis*, and a thicker, more complicated inner layer called the *dermis*.

The epidermis is composed of epithelial cells which are arranged in five layers, the outer one being called the *stratum corneum* and the innermost one the *malpighian layer* which lies next to the dermis. The stratum corneum consists of many layers of flattened, scalelike, tough, horny cells. These cells are being sloughed off constantly, in the form of fine scales, and replaced by cells from beneath. The horny nature of these cells is due to *keratin* which is an insoluble protein found also in fingernails, toenails and hair. There are no blood vessels or nerves in the epidermis. Pigment (melanin) which affects the color of the skin, occurs chiefly in the malpighian layer in special cells known as melanoblasts. It exists as fine granules and rods which vary in color from golden brown to dark brown. As these cells move outward to replace cells of the outer layers the pigment gradually disappears from them. The pigment is visible because the outer layers of the epidermis are partly transparent, i.e., translucent. The pigment increases in amount when the skin is exposed to sunlight. The physiologic reason for this is that the pigment protects the skin from excessive amounts of ultraviolet rays which may do it harm.



In colored races pigment occurs in considerable amounts in all layers of the epidermis.

The dermis, a much thicker layer, consists of loose connective tissue containing numerous blood capillaries, lymph vessels, nerves and muscles, in addition to sweat glands, sebaceous glands (oil glands) and hair follicles. The line of union between the epidermis and dermis contains minute elevations known as papillae. Some of the papillae contain nerve endings, others contain coils of blood vessels. The sweat glands are minute coiled tubes in the form of a ball surrounded by a network of blood capillaries. Each gland has a duct leading to the surface. The orifices of the hair follicles and the ducts of the sweat glands constitute the pores of the skin.

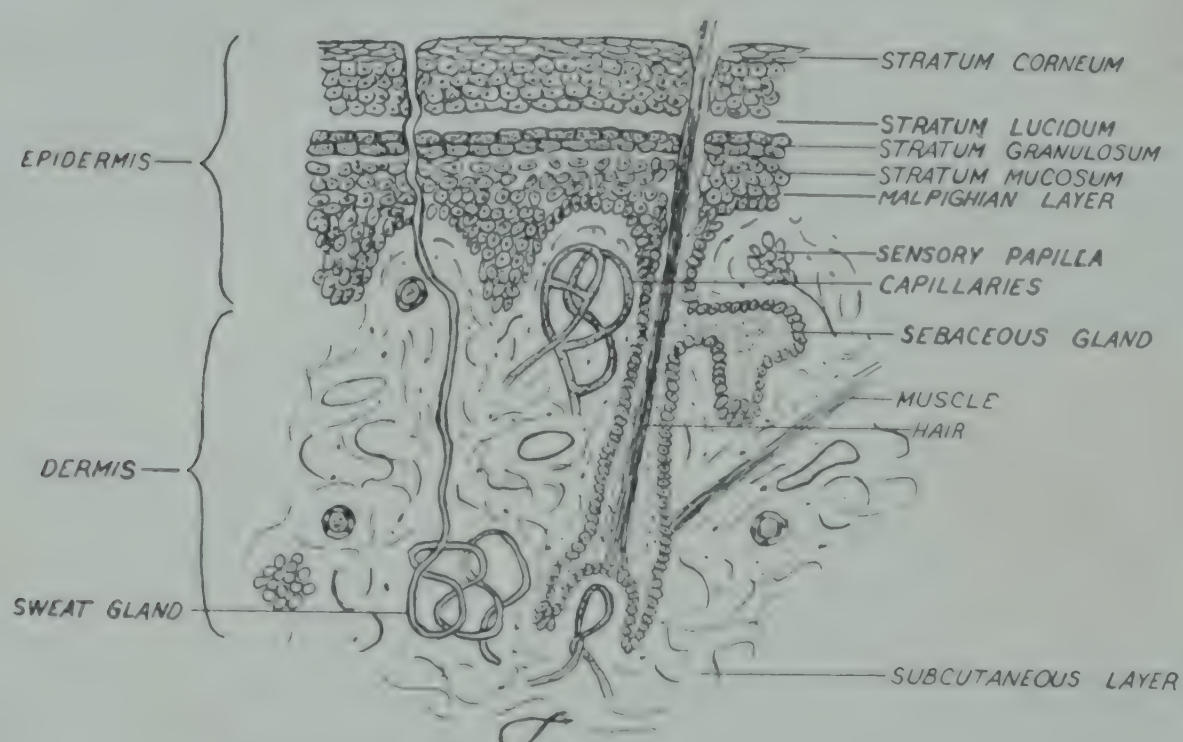


Fig. 32. Microscopic structure of the skin.

The pores are very numerous since the skin contains between two and three million sweat glands and an equal number of hair follicles. The popular belief that the pores can open and close is incorrect for actually they do not change in size. The sebaceous glands are usually associated with hair follicles and produce sebum, an oily secretion which keeps the hair glossy and the skin soft and pliable.

Beneath the dermis is the *subcutaneous layer* which contains considerable quantities of stored fat. It varies in thickness in different parts of the body. It serves as a buffer against shock and injuries, conserves the heat of the body, since fat is a poor conductor of heat, and gives the roundness to the contour of the body. This layer is thicker in women than in men.



### FUNCTIONS OF THE SKIN

Besides serving as a protective covering to the more delicate tissues underneath, the skin performs a variety of functions which, if interfered with, affect the health of the body. It is a very effective barrier against disease-producing microorganisms which otherwise would readily invade the tissues of the body. It contains nerve endings for touch, pain, temperature and pressure, and thus serves as an organ of perception. It is also a receptor for ultraviolet radiations from the sun. These rays change certain chemical constituents of the skin (sterols) into vitamin D. The sweat glands secrete from 1½ pts. to 2 qts. of perspiration a day.

The skin plays a very important role in regulating body temperature through its ability to conduct heat and evaporate perspiration. The body must be kept at a uniform temperature to function normally. A variation in temperature of even a few degrees tends to disturb the functioning of the body and brings on signs of distress such as headache, malaise and symptoms of fever.

### TEMPERATURE REGULATION

The body is continuously producing heat and dissipating heat into the air. The greater part (about 80 per cent) of the heat normally eliminated leaves the body through the skin. There is an automatic regulation between the generation of heat and the loss of heat from the surface of the body. These two processes are accurately balanced so that the temperature of the interior of the body is uniformly maintained at about 98.6° F.<sup>1</sup> The loss of heat is regulated by adjusting the flow of blood through the skin and varying the amount of perspiration produced.

An increased volume of blood in the skin results in an increased loss of heat from the body by conduction, convection and radiation of heat to the air. When it becomes necessary for the body to lose heat more rapidly the blood vessels in the skin become dilated to just the right extent, increasing the amount of blood in the skin and accelerating the loss of heat to the air. If the increased flow of blood through the skin does not suffice to keep the temperature of the body at the proper level the sweat glands become more active and secrete a sufficient amount of perspiration to bring about the necessary cooling of the body. The evaporation of perspiration has a cooling effect because it requires a large amount of heat to vaporize water. To convert 1 cc. of water at skin temperature into vapor

<sup>1</sup> Body temperature varies somewhat during the day; very early in the morning it may be as low at 97.3° F. and late in the afternoon it may rise to 99.1° F.



requires nearly 600 calories of heat. This heat is obtained chiefly from the body.

When one goes from a warm room into cold outside air the heat-regulating center of the nervous system causes the blood vessels of the skin to constrict, thus decreasing the amount of blood in the skin and averting the danger of losing too much heat to the cold air. When, on the other hand, one goes from a cold to a warm room the vessels of the skin dilate, which increases the amount of blood in the skin and insures adequate loss of heat to the air so that the temperature of the body will not rise above normal. If the room is very warm the heat-regulating center dispatches impulses to the sweat glands causing them to pour out more perspiration which by its evaporation brings about the necessary heat loss. Any interference with the functioning of the heat-regulating mechanism of the body will cause physiologic disturbances that may give rise to serious symptoms.

### GENERAL CARE OF THE SKIN

It is necessary to give the skin a certain amount of daily attention to keep it in a state of health so that it may perform all of its functions efficiently. The wearing of clothing in many cases gives the skin undue protection which tends to make it sluggish. The care of the skin should include measures to keep it active. Cleanliness, frequent bathing and exposure to cool air and sunshine are valuable hygienic measures for keeping the skin in a state of maximum health.

Skin cleanliness is desirable from the esthetic as well as hygienic standpoint. It makes for bodily comfort and self-respect. The perspiration eliminated by the skin tends to dry on the surface and together with the outermost cells which are constantly being shed, and dirt from the outside, form a debris which may irritate the skin and serve as a culture medium for microorganisms. Soap and water are the best cleansing agents for the skin. Because of the oil film covering the skin water alone will not clean it properly. Soap and water form an emulsion with the oil; i.e., they cause the oil to form minute globules which become suspended in the water. The emulsification of the oil loosens the dirt particles which are adsorbed, i.e., held on the surface of the soap particles. Soap has a definitely germicidal effect in that it kills certain kinds of microorganisms. This applies also to the synthetic detergents now available.

Soaps are sodium or potassium salts of fatty acids. Some free alkali is usually present. If there is too much, it will irritate the skin. A good toilet soap contains only a small fraction of 1 per cent of free alkali. Exagger-



ated claims are frequently made for certain brands of soap. All that can be expected of a good soap is that it serve as an adequate cleansing agent without doing any harm to the skin. Soap beautifies the skin only in that a clean skin is more attractive than an unclean skin. No soap can be truthfully represented to keep the skin young in appearance, to improve its texture, or to do anything for the skin except to cleanse it. In many advertisements of toilet soap an attempt is made to sell soap not as mere soap but as an agent that will produce beauty, romance and social success. No soap is superior to any other good soap in removing body odor. Body odor is caused by decomposed sweat and sebum on the skin or in the clothing next to the skin. Cleanliness of the skin will control this condition except in some extreme cases which may require medical care.

The temperature-regulating function of the body is capable of being trained and improved. Exposing the skin to cool air and bathing the body in cool water brings the temperature-controlling mechanism into play and causes it to become accustomed to adjust itself to sudden temperature changes. Sluggishness on the part of the temperature-controlling mechanism is harmful to the body.

#### HEALTH VALUE OF BATHING

Proper bathing helps to make the skin healthy and attractive. Bathing is of value not only for cleansing purposes but also for its effect upon the temperature-controlling mechanism, the nervous system and the circulation of the blood. Frequent bathing counterbalances to a certain extent the overprotection given the skin by clothing and the high indoor temperatures of houses and buildings in the winter time. Different kinds of baths affect the body in different ways.

**Cold Bath.** The cold bath (below 75° F.) has a tonic and invigorating effect on the skin and the body in general in a person in good health. It tends to improve the texture, tone, firmness and color of the skin and stimulates the circulation of blood throughout the body. The improved circulation through the skin means better nourishment and greater activity of the skin. The first effect of a cold bath is to chill the surface of the body. The cooling power of water is about fourteen times greater than air at the same temperature. The blood vessels of the skin contract, leaving only a minimum amount of blood in the surface of the body. In this way the heat of the body is conserved. Simultaneously oxidation is enormously increased. The oxygen needed for the increased oxidation is provided by the rapid breathing that accompanies a cold bath. The large amount of



heat produced by the increased oxidation brings about a return of blood to the skin.

The cold bath should last only a few minutes and should be followed by a reaction in which the feeling of chilliness gives place to a feeling of warmth and a sense of comfort. A healthy glow should come over the skin. A brisk rub with a rough towel adds to the beneficial effects of the cold bath. A cold bath is most conveniently taken as a shower bath. If a shower is not available a cold rub with a wet wash cloth or sponge is a good substitute.

The cold bath, if taken regularly, trains the skin to react quickly to external temperature changes and makes the individual less susceptible to chilling and to the common cold.

**Warm Bath.** The warm bath ( $90^{\circ}$  to  $100^{\circ}$  F.), in which the temperature is approximately that of the body, is of value chiefly to cleanse the skin. With the aid of soap it serves this purpose well. Because its temperature approaches that of the body the warm bath does not have much stimulating effect on the skin or the circulation. It soothes the nervous system and may be used to invite sleep if taken just before retiring. A warm bath for the purpose of keeping the body clean should be taken at least twice a week. It is an excellent health habit to take a daily cleansing bath followed by a cold shower or sponge bath.

**Hot Bath.** The hot bath (above  $100^{\circ}$  F.) has a temperature above that of the body. It raises the temperature of the surface of the body and causes the blood vessels of the skin to dilate. It thus causes an increased flow of blood (hyperemia) through the skin by withdrawing a large quantity of blood from the interior organs. The change in circulation produced by the hot bath has a beneficial effect in cases of stagnation of blood in the deeper organs of the body. If a hot bath is long continued faintness may occur as well as harmful disturbances of the heat-regulating mechanism.

It is not advisable to go out into the cold immediately after taking a hot bath because there is danger of chilling the body due to the dilated skin vessels and the large amount of blood in the skin. If a hot bath is taken daily the temperature should be only a few degrees above that of the body. If the water is very hot the bath may have a weakening effect. In a frail individual it may cause fainting or disturb the heat-regulating mechanism.

### COSMETICS AND THE COMPLEXION

The complexion depends upon (1) the texture of the epidermis, (2) the number and arrangement of blood vessels in the dermis, (3) the amount of pigment in the epidermis and (4) the general health of the



body. The general health of the body is a very important factor. The complexion often reflects the general condition of the body through changes in texture or color. Digestive disturbances, constipation, lack of fresh air and exercise, insufficient sleep and worry are factors which may influence the complexion. A clear, healthy complexion usually can be acquired by right habits of living. The underlying principles of health are also the underlying principles of an attractive complexion. A good complexion is an outward sign of good health.

Cosmetics have come into general use as aids to beauty. Most of the cosmetic preparations on the market may be used with safety by most individuals, to enhance the appearance of the face, but they should not be looked upon as being basic to the health of the skin or as agents possessing magic powers. The user of cosmetic preparations should realize that the advertising claims made for many of them are exaggerated and misleading. Cosmetics occasionally do harm because people are sensitive to certain ingredients they contain and develop dermatitis (skin inflammation) when they use such preparations.

**Cosmetic Powders.** A face powder is usually a mixture of a number of components. Among the ingredients commonly incorporated are zinc and titanium oxides, zinc and magnesium stearates, calcium and magnesium carbonates, talc, starch, lithopone, barium sulfate and lycopodium. Color is added to produce the desired shade, and perfume to provide an identifying scent. Powders are sometimes useful to produce a soothing effect on an irritated skin. Dermatitis due to face powders is not of common occurrence. Some persons, however, may be sensitive to the perfume present in a certain powder and develop a skin rash from its use. If used too freely or if rubbed into the skin, powders may get into the hair follicles and plug the ducts of the sebaceous glands. This may lead to an infection known as folliculitis.

**Face Creams.** The face creams at present are of three types: (1) cold creams, which are fatty creams; (2) vanishing creams, which do not contain fat; and (3) massage creams. Cold creams are usually free of harmful ingredients.<sup>2</sup> They are of value when the skin is inclined to be dry or when it is exposed to the drying action of the sun or wind. The so-called "skin foods" or "nourishing creams" belong to the category of fatty creams. They are entirely worthless, since the skin, like other organs, is nourished from within by the circulating blood and lymph. Vanishing creams are

<sup>2</sup> The following is a typical formula of a cold cream: 60 per cent heavy mineral oil (petrolatum), 15 per cent white wax, 1 per cent sodium borate, 24 per cent water and some perfume.



basically soaps and usually contain no harmful ingredients.<sup>3</sup> If dermatitis occurs it is usually due to the perfume or to the alkalinity of the cream. Massage creams contain milk casein (protein) and other ingredients such as sodium borate, alum, sodium benzoate, perfume and coloring matter. No special benefits can be expected from their use.

**Lipsticks.** Lipsticks are mixtures of oils, fats, waxes, perfume and coloring matter. They often cause inflammation of the lips (cheilitis). A point in their favor, beside the lure they are supposed to impart to feminine lips, is the fact that they tend to prevent chapping and cracking of the lips.

**Freckle Removers.** The removal of freckles can seldom be accomplished successfully. Freckles are pigmented areas located at various depths in the skin. Bleaches such as lemon juice washes and peroxide solutions are sometimes used to remove light-colored, surface freckles. The more efficient types of freckle removers bring about a peeling of the superficial layers of the epidermis and thus remove many of the freckles. This treatment is not without danger since it may give rise to a serious inflammation of the skin.

**Nail Preparations.** Harmful effects may follow the use of certain nail preparations. The base coat, which is applied directly to the nail before the polish is applied, may contain harmful ingredients. Recently the change in formula of one of these preparations caused hundreds of cases of nail disorders. The symptoms included discoloration, separation of the nail from its bed, pain and a change in the skin surrounding the nail. Some nail preparations cause the nails to become fragile and to split.

The Federal Food, Drug and Cosmetic Act contains provisions with respect to the purity and labeling of cosmetics. Cosmetics are considered adulterated if they contain poisonous or deleterious substances which may make them injurious to users under conditions of use prescribed in the labeling or under conditions of use as are customary or usual. Cosmetics are regarded as misbranded if the labeling is false or misleading. The law defines the term "cosmetic" as a substance intended only for cleansing, beautifying, promoting attractiveness or altering the appearance of the user.

### THE SCALP AND ITS CARE

The most important factor in the care of the scalp is keeping it clean. Dermatologists advise that the scalp be washed with good soap and water about once in two weeks. If the scalp is oily, more frequent washing is

<sup>3</sup> A typical formula: 50 parts stearic acid, 10 parts oleic acid, 2½ parts potassium hydroxide, 200 parts of water and some perfume.



desirable. Rubbing the scalp with the finger tips stimulates the circulation of blood.

**Dandruff.** Dandruff is a normal product of the scalp consisting of the outermost dead cells of the epidermis that have been shed from the skin. The entire skin is constantly shedding the dead superficial cells. On the scalp this material has a tendency to accumulate because the hair keeps it from falling off readily. It is more abundant in persons with greasy skin and in those who may have some abnormal condition of the scalp.

Some persons have an excessive amount of dandruff. There is no evidence that dandruff is caused by germs. Advertisements of antiseptic solutions that imply this are misleading. So-called "dandruff removers" may cause dermatitis in some persons.

**Baldness.** Human males are susceptible to baldness which is a sex-linked, hereditary trait. Millions of dollars are spent every year for so-called "hair tonics" and futile hair-restoring treatments. The Committee on Cosmetics of the American Medical Association informs us that "neither massage, mechanical devices, tonics, ultraviolet light, hormones, vitamins, nor any other treatment will regenerate hair lost in ordinary baldness of older men or in premature baldness of young men."

**Hair Dyes.** Hair dyes are of three general types: (1) vegetable colors, (2) metallic salts and (3) synthetic organic dyes. Vegetable dyes such as henna, walnut juice, sage and indigo are natural dyes derived from the plant world. They are the safest to use but are less effective than the other types. Certain metallic salts, chiefly salts of lead, silver and copper, can be used as hair dyes because they enter into chemical combination with the sulfur in the keratin of the hair, thus forming a coating on the hair shaft. Several applications are usually required to produce satisfactory results but more rapid action can be obtained by using a chemical known as a "developer" such as pyrogalllic acid, in conjunction with the metallic salt. These dyes may cause skin irritation. The synthetic organic dyes are the most efficient but constitute a greater potential health hazard than the other kinds. In some individuals they give rise to severe inflammation of the skin of the face and neck, as well as general symptoms of poisoning. The most extensively used of this class of dyes are paraphenylenediamine and paratoluylenediamine. Federal law forbids the sale of these dyes for use on eyelashes or eyebrows because they may cause damage to the eyes, including blindness.

The Federal Food, Drug and Cosmetic Act requires that the label of a synthetic organic hair dye contain the statement, "Caution—This product contains ingredients which may cause skin irritation on certain individuals and a preliminary test according to accompanying directions



should first be made. This product must not be used for dyeing the eyelashes or eyebrows; to do so may cause blindness.”

**Hair Waving.** In the cold waving process used to produce what is known as a “permanent wave,” chemicals such as inorganic sulfides or thioglycolates are used to soften the hair, following which oxidizing solutions are used to “set” the curl. Gums or resins are usually added to hold the curl. Dermatitis may result in those persons who are sensitive to one or more of these substances.

### CARE OF THE HANDS

The chief health care of the hands consists in keeping them clean. Hands become contaminated readily with microorganisms of various kinds and play a rather important role in spreading disease. It is advisable to wash the hands frequently during the day, using warm water and soap. Whenever the hands have come in contact with objects that may have been contaminated with microorganisms they should be washed thoroughly. It is especially important to wash the hands immediately before eating or handling food and before leaving the toilet room.

The nails should be trimmed closely and neatly manicured. It is advisable to use an orange-wood stick to push back the cuticle and clean under the nails, and a flexible nail file for shortening the nails. Biting the finger nails is an abominable habit. Pathogenic bacteria are often present under the nails. The fingers should not be placed into the mouth, nose or eyes. The habit of turning the pages of a book with a finger moistened with saliva is unhygienic. Scratches or breaks in the skin should be treated with mild tincture of iodine or some other suitable antiseptic. “The cleanliness of the human hands can never be guaranteed, because their many functions subject them to an endless chain of infection. Yet the average person uses them as if they are fitted with sterile gloves.”<sup>4</sup>

### SKIN BLEMISHES AND DISORDERS

Blemishes at times occur on skins which are otherwise normal. Moles, warts and freckles should not be tampered with by the individual. Serious consequences may follow attempts to remove them. They should be treated only by a competent physician. Moles, particularly the deeply pigmented ones, occasionally serve as starting points for the development of skin cancer.

A number of chemicals, such as alkaline sulfides of barium or sodium, are frequently employed for the removal of superfluous hair. They do not accomplish the permanent removal of the hair and may irritate the skin

<sup>4</sup> From Bulletin of Milwaukee Health Department.



sufficiently to cause infection. X-rays have a hair-destroying effect, but in order to remove hair by this method the dosage required will do permanent damage to the skin. Superfluous hair can be safely removed by the electric needle by a skilled operator. Before having this done the family physician should be consulted so that the individual will not fall into the hands of a quack.

The most common skin disease of youth is acne or "pimples" which affects the face primarily but appears also on the chest and back. It is a disease of the sebaceous glands and is characterized by an oily skin, black-heads, pimples and red nodules. It usually disappears after two or three years but sometimes lasts for many years. Although it is difficult to cure modern methods of treatment have been developed which produce very good results. Prompt treatment by a competent dermatologist will usually prevent the face from becoming permanently scarred.

To overcome the condition attention to diet is of value. Fruits, vegetables and milk should be included in ample amounts, candy should be eliminated, sweets in general restricted and iodized salt avoided. The use of all cosmetic creams must be discontinued, the face washed with a good toilet soap twice daily and kept as free of grease as possible. Outdoor exercise, fresh air and sunshine, and all other measures conducive to good general health are helpful in overcoming acne.

### HEALTH PRACTICES TO BE ACQUIRED

To maintain the functional activity of the skin the following health practices are suggested:

1. A daily cleansing bath using warm water and soap followed by a cold or cool shower to keep the temperature-controlling mechanism in good condition.
2. A daily air bath if possible. Engage in physical activity while taking the air bath.
3. Use cosmetics judiciously and avoid those that are definitely known to be harmful.
4. Wash the scalp and hair every two weeks.
5. Wash the hands frequently, especially immediately before eating, before handling food, before leaving the toilet room, and after having come in contact with objects contaminated with microorganisms.
6. Keep the finger nails clean.

### QUESTIONS FOR CLASS DISCUSSION

1. Explain the structure of the skin.
2. Define: (1) keratin, (2) melanin, (3) sebum.



3. What is meant by the pores of the skin?
4. What purpose do the sebaceous glands serve?
5. Name the functions that the skin performs.
6. Explain the role of the skin in the regulation of body temperature.
7. Explain how perspiration cools the body.
8. Discuss the general care of the skin.
9. Why is cleanliness important in the care of the skin?
10. What is soap? Why is it needed in the care of the skin?
11. Explain the health value of the cold bath in regard to its effect on (a) the skin, (b) the circulation, and (c) metabolism.
12. What is the chief value of the warm bath?
13. How does the hot bath affect the skin?
14. What health practices are needed to keep the temperature controlling function of the skin in good condition?
15. What should one do to have a good complexion?
16. Is there any danger in the use of cosmetics?
17. Which cosmetics are quite safe to use?
18. Name cosmetic preparations that may be dangerous to health.
19. Are any cosmetics actually basic to the health of the skin?
20. What care does the scalp require?
21. What is dandruff? How may it be prevented from accumulating on the scalp?
22. Are hair dyes safe to use? Explain.
23. What care should the hands receive? How often and when should they be washed?
24. Is it safe for an individual to tamper with skin blemishes or disorders?
25. What is acne? Give the treatment that is usually helpful.
26. Summarize the health care of the skin.

### TOPICS FOR ORAL OR WRITTEN REPORTS

1. Clip from one issue of a magazine or newspaper all of the advertisements for toilet soaps, or list those you hear over the radio. Do they furnish scientific information? Are they truthful? Do they exaggerate? Do they appeal to reason or to emotion?
2. Investigate the rules and regulations of your state or community in regard to the sanitary requirements of barber shops and beauty parlors.
3. Make a study of ivy poisoning, including its prevention and treatment.
4. Report briefly on one of the following: (a) warts and moles, (b) impetigo, (c) eczema, (d) boils and carbuncles, (e) scabies or "the itch," (f) erysipelas, (g) treatment of serious skin burns.
5. Outline a program for the proper care of the skin, explaining the reasons for each recommendation.

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## CHAPTER 11

### *Clothing and Health*



THE kind and amount of clothing worn have a direct bearing on human well-being. Clothing may assist the body in the maintenance of health but it may also be detrimental to health. In choosing clothing, one should give consideration not only to its ornamental value but also to its hygienic aspects. Since clothing diminishes the heat loss from the body, its chief purpose from the health point of view is to assist in maintaining the normal temperature of the body when atmospheric temperatures are low.

Dame Fashion, rather than Hygeia, rules in the realm of clothing and often imposes upon people raiment which is detrimental to health. Fashion frequently ignores both the hygiene and esthetics of clothing. If clothing were planned and designed by hygienists in cooperation with artists it could be made to accord with the principles both of esthetics and hygiene. Custom and the vagaries of fashion should not be permitted to interfere with health.

#### PROPERTIES OF CLOTHING MATERIALS

The chief materials used for clothing are cotton, rayon, wool, linen, silk, nylon and fur. Most of these are natural products obtained from the plant or animal kingdoms. Rayon, however, is a man-made fiber produced from cellulose and nylon is a synthetic material.

Heat is conducted through some materials more readily than through others. The insulating property of clothing materials depends upon the texture rather than the kind of fibers of which the fabric is made, i.e., whether it is knitted or woven, and whether it is loosely or tightly woven. The different kinds of fibers vary somewhat in their thermal conductivity but this does not appreciably affect warmth. Warmth depends chiefly on the amount of still air trapped in the meshes of the clothing since the heat-conducting capacity of air is much lower than that of any of the fibers. Smooth, closely woven fabrics have about 50 per cent air enmeshed in about 50 per cent fibrous material, whereas some loosely woven woolen



fabrics are composed of about 90 per cent air enmeshed in 10 per cent of fibrous material. Two layers of any fabric permit less heat loss than a single layer of the same total weight, because of the air held between the layers. A heavy outer garment may not be so good an insulator against heat loss as one of lighter weight which holds more trapped air. Besides the insulating property of clothing, the ability to absorb moisture (perspiration) is an important matter in regard to clothing worn next to the skin.

The elasticity and rough, scaly surface of wool fibers cause wool to weave into cloth which is loose in texture and, therefore, contains innumerable air spaces. It is chiefly for this reason that woolen clothing is warmer than that made of other materials. When used as underwear wool absorbs perspiration readily but does not permit the rapid evaporation of the perspiration. It will thus become moist when worn for a while, which is an undesirable feature. Since houses and buildings are usually kept at a temperature of 70° F. during the winter season, it is advisable to wear light underclothing throughout the winter and sufficiently warm outer garments to protect the body adequately when going out of doors. Wool is very satisfactory for outer garments.

Cotton, the world's most widely used textile, is very satisfactory for underwear throughout the year. It is a good heat conductor, absorbs moisture readily and gives off its moisture quickly. Knitted cotton fabrics conduct heat less rapidly than woven ones because of their greater air content. Linen absorbs moisture readily and dries quickly. It conducts heat more readily than cotton and is desirable for hot weather wear. It will endure hard wear. The fibers lack elasticity which causes linen clothing to wrinkle readily. Rayon and silk absorb moisture well but do not dry so quickly as cotton.

### **CHOOSING HEALTHFUL CLOTHING**

Clothing may hamper health by interfering with the normal functions of the skin or body in general. In order to serve its purpose adequately, clothing must not impede body movements, be needlessly heavy or constrict any part of the body. Garments that fit too tightly hinder the circulation of the blood, interfere with freedom of movement, make correct posture difficult and impair personal efficiency. This applies to tight belts, foundation garments, girdles, brassieres, and waistbands. Clothing which changes the natural outline of any part of the body is capable of doing harm. Garments which require suspension should hang from the shoulders or hips, not from the waist.



The choice of correct underclothing is particularly important. It should be loose and porous, absorb moisture well and permit its ready evaporation. Outer garments as well as underclothing should be permeable to air. It should be varied according to atmospheric conditions and should be chosen with the object of keeping the body from being chilled in cold weather or overheated in warm weather. Heavy winter wraps may cause fatigue.

In hot weather loose, light garments of open texture are suitable because they allow free circulation of air over the skin, and rapid elimination of heat and moisture. Tight clothing keeps a hot and humid layer of air in contact with the skin. When the temperature of the air is higher than that of the body the entire heat loss from the body is implemented by the evaporation of perspiration. It is evident that clothing which permits of ready evaporation is needed. For wear in the summer it is advisable to choose clothing that will expose a large area of the skin to the direct rays of the sun. Light-colored clothing is more suitable in summer than dark-colored kinds, because light colors reflect more of the heat rays of the sun.

#### **CLOTHING AND BODY CLEANLINESS**

Clothing has an effect on the cleanliness of the skin. If not frequently changed and washed, underwear becomes moist with perspiration and is then a suitable breeding place for microorganisms of various kinds. Such clothing is offensive to the sense of smell, irritates the skin and gives rise to infections of the skin. The number of bacteria on each square inch of underclothing increases rapidly with the number of days it is worn. In an experiment carried out at the University of Nebraska underclothing worn for six days contained 10,000,000 bacteria per square inch. To keep the body fresh and clean it is advisable to change underwear three times a week, or preferably daily. This also applies to hosiery. The wearing of clean clothes has a desirable psychological effect.

#### **AMOUNT OF CLOTHING REQUIRED**

The amount of clothing to wear depends upon the vitality and rate of metabolism of the individual as well as his habits and occupation. Some persons have a higher metabolic rate than others and consequently require less clothing than those with a lower metabolic rate. An amount just sufficient to conserve the heat of the body should be worn.

Too little clothing hampers the body in maintaining its normal temperature. In the underclad individual too much energy is expended for the purpose of keeping the body warm. The body is likely to become chilled



and the internal organs congested. This lowers the vitality of the body and makes it susceptible to certain infectious diseases, particularly those of the respiratory tract. The arms, chest and legs are often inadequately protected in cold weather. The body should be clothed evenly to prevent excessive heat loss from certain parts and thus prevent congestion of blood in the internal organs.

Clothing which overprotects the body against heat loss may weaken the temperature-controlling mechanism of the skin to such an extent that it becomes sluggish and thus loses its ability to make rapid adjustments when the need arises for it to do so. Too much clothing affects the body in a manner similar to that of foul air and may result in mental dullness and lack of physical energy. The amount of clothing worn should be just enough to produce a sense of comfort. More than that is superfluous.

### **PSYCHOLOGICAL ASPECTS OF CLOTHING**

From the point of view of mental health the attire of an individual is important. Clothing has much to do with the emotions. The emotional aspects of clothing are as important to mental health as the physiological ones are to bodily health. Knowing that one is dressed becomingly produces a pleasant emotional effect. Consciousness of good personal appearance is conducive to self-confidence and self-respect.

Undue attention to one's dress, however, is undesirable. It is time-consuming and may make a person vain in that it gives rise to empty pride in personal appearance. The well-adjusted person does not permit himself to give undue consideration to the style or appearance of his apparel. His main interests in life are much more fundamental than the whims of fashion and personal appearance.

### **HEALTH PRACTICES TO BE ACQUIRED**

To apply the principles of the hygiene of clothing to one's daily life requires the following health practices:

1. Wear a sufficient amount of clothing to aid the body in maintaining its normal temperature.
2. Select underclothing that permits perspiration to evaporate readily.
3. Choose clothing that is sufficiently loose to allow complete freedom of movements of the arms, legs and trunk of the body.
4. In the summer wear clothing that exposes part of the skin to the rays of the sun.
5. Wear fresh, clean underclothing at all times.
6. Give sufficient attention to your clothing so that your personal ap-



pearance will be conducive to self-confidence and self-respect, but do not give undue attention to the style or appearance of your apparel.

### QUESTIONS FOR CLASS DISCUSSION

1. What is the chief purpose of clothing from the hygienic point of view?
2. Is fashion in clothing based upon hygienic factors? Do you think it should be?
3. Why is it of value to give careful consideration to what one wears?
4. Upon what does the thermal conductivity of clothing materials chiefly depend?
5. How does the thermal conductivity of air compare with that of wool, silk, cotton and linen fibers?
6. Why is woolen clothing warmer than that made of other materials?
7. Which fabrics are suitable for underwear? Why?
8. What are the properties that hygienic underclothing should possess?
9. How may the temperature regulation of the body be assisted or hindered by clothing?
10. Why is tight-fitting clothing harmful?
11. What harm results from insufficient clothing?
12. Is it harmful to wear too much clothing? Why?
13. How much clothing should one wear?
14. Do you think that there are any health risks involved in the present custom of clothing the upper portions of the body warmly while the legs and feet are very scantily clad?
15. Does clothing have any effect on the health of the mind? Explain.
16. Summarize the important points that need to be considered in choosing healthful clothing.

### TOPICS FOR ORAL OR WRITTEN REPORTS

1. Have you any suggestions concerning needed reforms to make the clothing of men and women conform more closely to the principles of hygiene?
2. Report briefly on one of the following: (a) the modern dyeing of fabrics, (b) methods of testing fabrics, (c) the adulteration of fabrics, and stain removal.

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## CHAPTER 12

### *Relation of Air to Health*

THE earth not only consists of the solid ground beneath our feet but includes the encompassing mixture of invisible gases known as the atmosphere. This gaseous envelope is an integral part of the earth and is kept from escaping into the outer space by the force of gravitation. The atmosphere is an important part of our environment not only because it provides us with the oxygen required for energy metabolism, but also because the condition of the air surrounding the body has a direct bearing on health and comfort.

#### COMPOSITION AND CHARACTERISTICS OF AIR

Air is a mixture of a number of different kinds of gases. At the bottom levels, where man lives, two gases comprise almost the whole bulk of the atmosphere, namely nitrogen, 78 per cent, and oxygen, 21 per cent. In addition to these there is a little less than 1 per cent of argon, 0.03 per cent of carbon dioxide, as well as traces of helium, neon, xenon and krypton. Mingled with these gases, which may be referred to as the constant elements of the air, are small, variable quantities of water vapor, dust particles, microorganisms and other chance components. They occupy the spaces between the molecules of nitrogen, oxygen and the other constant gases. Water vapor is present at all times due to the fact that water readily evaporates from the earth's surface. Most of it comes from the oceans which make up nearly three-fourths of the earth's surface.

Because air has weight it exerts pressure. At sea level a column of air one square inch in cross section, extending to the uppermost boundary of the atmosphere, has an average weight of 14.7 pounds. In other words, the atmospheric pressure is 14.7 pounds on every square inch of surface. Air pressure varies from place to place and fluctuates at any given locality. It is measured with an instrument called a *barometer*. Changes in air pressure are important to meteorologists in helping them to forecast the weather.



### STRUCTURE OF THE ATMOSPHERE

The science of the atmosphere, known as *meteorology*, is of particular interest to modern man in the "air age" in which he is living. The atmosphere is densest at the earth's surface and gradually decreases in

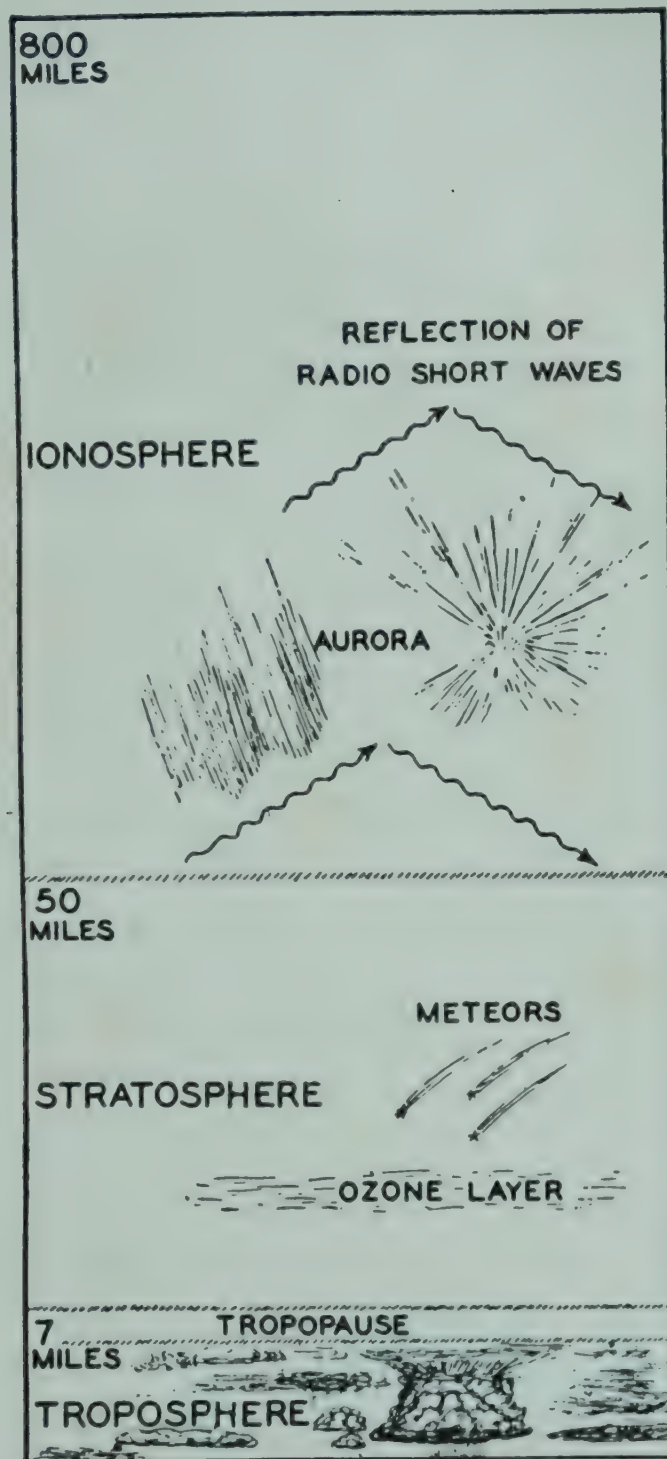


Fig. 33. Structure of the atmosphere. (Neuberger and Stephens, *Weather and Man*. Courtesy of Prentice-Hall, Inc.)

density as the altitude increases. At a height of five miles it is too thin to support human life.

The atmosphere may be divided vertically into three layers, the *troposphere*, *stratosphere* and *ionosphere*. Each of these layers possesses distinctive features. The troposphere, the layer in which we live, is the lowest of the three layers. It extends upward to a height of about six miles



at the poles and eleven at the equator. Although this layer is the smallest in vertical extent it contains about four-fifths of the total weight of the atmosphere. There is a uniform decrease in temperature with increase in altitude. In the upper part of the troposphere (the tropopause) the temperature decline is very small or comes to a halt. The temperature is around  $-70^{\circ}\text{F.}$  in this zone. The stratosphere has a depth of about fifty miles. The temperature, about the same as that of the upper part of the troposphere, apparently remains practically constant. Without temperature changes there is obviously no air motion, no winds or storms. Not much is known about the third layer, the ionosphere, which lies above the stratosphere. It possesses certain electrical properties which enable it to reflect back to the earth the short radio waves used in long-distance radio transmission.

### HUMIDITY

Humidity refers to the water vapor present in the air, i.e., to the vapor pressure. Water vapor is an essential air constituent for the plant and animal life of the earth. When a mass of air contains all the moisture it is capable of holding it is said to be *saturated*. The higher the temperature the more moisture it takes to saturate the air because the capacity of air for holding moisture increases with the temperature. At  $20^{\circ}\text{F.}$  the maximum amount of water air can hold is about 1 grain per cubic foot, whereas at  $90^{\circ}\text{F.}$  it can hold about 15 grains per cubic foot. The amount of moisture present in the air varies from time to time; it may be very small or reach the saturation point.

The actual amount of moisture in a mass of air at any given time is known as *absolute humidity*, which is usually expressed as the weight in grains per cubic foot of air. Since there is no convenient way of determining absolute humidity, the moisture content of the air is usually expressed in the form of *relative humidity*, which may be defined as the quantity of water vapor the air holds in comparison with what it could hold, at the same temperature and pressure, when saturated. It is expressed in percentage. Thus, if air contains only one-half of the moisture necessary to saturate it, the relative humidity is 50; if only one-fourth, it is 25. When the temperature of a given mass of air is raised, its capacity for holding moisture is increased with a consequent drop in relative humidity. Conversely, when the air is cooled, its relative humidity increases because its moisture-holding capacity has been decreased.

The instrument usually employed by meteorologists in determining relative humidity is the *psychrometer* which contains two thermometers



mounted on a frame, one being a wet bulb, the other a dry bulb thermometer. The *hair hygrometer*, frequently used in homes, contains a delicate pointer which is actuated by a bundle of human hair. Hair lengthens when the humidity increases and shortens when it decreases.

### **FUNCTIONS OF AIR IN AND SURROUNDING THE BODY**

Since the human body is a heated body, the air that surrounds it serves the important purpose of removing its excess heat, thus keeping it from becoming too warm. Air thus exerts a cooling action on the body. The characteristics of air that influence its cooling properties are (1) temperature, (2) motion and (3) relative humidity. The relation of these physical properties of air to heat dissipation will be explained in another section of this chapter.

Air has another use. It provides the oxygen needed for the process of oxidation which furnishes the body with practically all of the energy it requires for its daily activities.

### **OUTDOOR AIR**

The refreshing and vitalizing effects of outdoor air have been recognized since the days of antiquity. It is well known that fresh air is one of the most valuable hygienic agents for the promotion of health. Fresh air stimulates metabolism, improves the functioning of the skin, favors the circulation of the blood, helps to keep the nervous system in good tone, stimulates the appetite and digestion and keeps the lungs healthy. It has a tonic action on the body and tends to give color to the complexion.

The physical and mental improvement of children in open-air schools is a demonstration of the value of fresh air. Invalids who can be kept out-of-doors usually give evidence of being greatly benefited by such treatment. Weaklings at times become physically fit individuals through open-air treatment. The value of fresh air in the treatment of tuberculosis has been clearly demonstrated.

### **INDOOR AIR**

Indoor air, if not properly conditioned, may have an adverse effect on the body. It is common experience that when a group of people are confined in a poorly ventilated room they will soon become uncomfortable. There will be a feeling of dullness, languor and malaise, and a reduction in mental and bodily vigor. Under more extreme conditions headache, faintness and nausea may occur. Repeated or continuous occupation of poorly ventilated rooms may give rise to anemia, disturbances



of digestion and lowered resistance to infectious diseases. In very extreme cases foul air has caused death. This occurred in the year 1756 in the well-known tragedy of the Black Hole of Calcutta, and in 1848 on the steamer Londonderry.

### CAUSES OF THE ILL EFFECTS OF AIR

Experiments have demonstrated that the harmful effects air is capable of producing are due to its physical rather than chemical properties. At one time the harmful effects of foul air were ascribed to the reduction of the oxygen content to a degree detrimental to health. It is now known that even in very poorly ventilated, crowded rooms the percentage of oxygen seldom drops below 20 per cent. Leakage of air into rooms through cracks as well as walls, ceilings and floors which are more or less porous, prevents a greater reduction in oxygen content. It has been found that the oxygen content of air must be reduced to 14 per cent or below before harmful effects are noted.

Another fallacious concept formerly held was that the increased amount of carbon dioxide in the air of a poorly ventilated room exerted a poisonous effect. It is now known that carbon dioxide does not reach a harmful concentration in the ordinary, poorly ventilated, occupied room. It rarely rises above 0.5 per cent. It must increase to 5 per cent or above to produce discomfort.

Another explanation now known to be erroneous was that organic poisons (crowd poisons) exhaled by and emanating from the body affected the well-being of persons in poorly ventilated rooms. It is known that organic matter is present in exhaled air. It gives the fetid odor to foul air and seems to exert a minor effect on the body, but there is no evidence that it gives rise to the more serious effects of so-called foul air.

The actual causes of the distress produced by the air of a poorly ventilated room have been determined by a series of investigations by Flügge, Paul, Haldane, Hill and others. Many experiments have been carried on in which human beings were placed in air-tight chambers which were equipped with electric heaters, cooling coils and electric fans so that the temperature and motion of the air could be controlled.

Individuals placed in one of these chambers experienced the usual symptoms associated with poor ventilation after being in the chamber for a while. The temperature of the air in the chamber increased and the relative humidity reached a high point. Relief was not obtained when the



occupants were permitted to breathe outside air through tubes. Persons on the outside, where the ventilation was good, breathing the foul air of the chamber through tubes suffered no ill effects from it.

When the air in the chamber was placed in motion by means of an electric fan the occupants became comfortable again even when the carbon dioxide content had risen to 3 or 4 per cent and the oxygen decreased to 16 or 17 per cent. Lowering the temperature by means of the cooling coils also gave relief to the occupants. Raising the temperature of the chamber by means of an electric heater brought on feelings of distress very rapidly.

These experiments show that the harmful effects of foul air are due to high temperature, high relative humidity and lack of motion of the air. These three physical factors determine the cooling properties of air. It is obvious that air at a high temperature has less cooling action than air at a lower temperature. It is also obvious that motion increases the cooling action of air. High relative humidity becomes a factor when it accompanies high temperature. When the temperature of the air is high the body loses its excess heat largely through perspiration and the evaporation of the perspiration. When the humidity is high evaporation of perspiration is retarded due to the high vapor tension of the air. With a low air temperature high relative humidity would not have this effect since evaporation of perspiration would not then be a factor in the cooling of the body; it would have the opposite effect for cool, moist air removes heat from the body more rapidly than does cool dry air.

The ill effects of poor ventilation are, therefore, not due to any variation in the chemical make-up of the air breathed since the chemical composition of air does not become significantly changed under the usual conditions in occupied rooms. In an air-tight chamber the oxygen of the air would after long occupancy become deficient in amount but in an ordinary room the cracks and porous walls, floors and ceilings permit enough air to enter to keep this from occurring. The physical condition of the air is the important consideration. The temperature, humidity and lack of motion of the air that surrounds the body are the three factors which give rise to the distress of foul air because they determine the rate of heat loss from the body. Altering one of these factors may either decrease or increase the cooling capacity of the air. Interference with the normal rate of heat dissipation disturbs the heat equilibrium of the body and gives rise to physical and mental symptoms more or less serious from the point of view of efficiency and well-being.



**AIR CONDITIONING**

The air in buildings can now be conditioned throughout the year in regard to temperature, humidity, purity and movement. The prime objective of air conditioning is to keep the temperature and humidity of the air within a suitable range. Indoor air to be healthful should be relatively cool and in gentle motion. It will then have sufficient cooling power to permit the ready dissipation of excess heat from the body. The relative humidity of the air also becomes a factor in its cooling power under certain conditions of temperature.

**Winter Air Conditioning.** For winter the minimum requirements are heating, humidification and circulation of air. Investigations of the New York State Commission on Ventilation showed that a room temperature of 65° to 68° F., and a relative humidity of 30 to 60 per cent were most satisfactory for the health and efficiency of sedentary workers. It also found that slight variation of temperature and motion adds a stimulating action that air of uniform temperature and motion does not possess. High humidity makes air of high temperature feel hotter while high humidity with low temperature makes the air feel colder. At intermediate temperatures (65° to 68°) humidity has little effect.

The temperature of 68° F., is looked upon as the "critical temperature" since above this temperature relative humidity and air motion become more important factors. At 68° a high relative humidity does not interfere appreciably with heat loss but when the temperature rises above this point evaporation of moisture from the skin is necessary to produce sufficient cooling of the body. Because high humidity retards evaporation of perspiration, the combination of air temperature above 68° and high relative humidity interferes with the normal loss of heat from the body. In the temperature range of 65° to 68° the absence of air motion does not materially affect the heat abstracting power of air. Above 68° the absence of air motion will affect quite noticeably the comfort of the occupants. In view of the above considerations the temperature range of 65° to 68°F. may be called the health zone for indoor air. Aged people and invalids require a higher temperature for comfort due to the fact that their bodies produce heat at a slower rate. Automatic heat control is desirable since without it there is a tendency to overheat.

When winter air of average temperature (30° F.) and humidity (70 per cent) is heated in a building to 70° F., its relative humidity drops to about 20 per cent unless it is artificially humidified. When such air is overheated without adding any moisture, the humidity may drop so low as to exert a decided drying action on the skin and the mucous membranes



lining the nose and throat. This may increase susceptibility to the common cold and other respiratory disorders. Authorities now believe that a low moisture content of the air is not harmful to the body unless the humidity drops below 20 per cent. It should be noted that when the humidity is very low a temperature of 70°F. may feel uncomfortably cool due to the rapid evaporation of moisture from the skin.

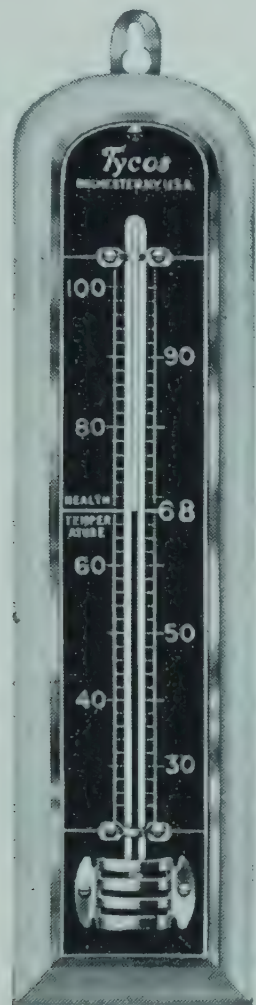


Fig. 34. Keep the indoor temperature at 68° F. during the seasons when artificial heat must be used. (Courtesy of Taylor Instrument Companies.)

In complete air conditioning the air is also filtered or washed by passing it through, or spraying it with, water. This takes out dust, bacteria and other foreign matter.

**Summer Air Conditioning.** In the summer season the air must be cooled, dehumidified and circulated. Dehumidification is necessary because cooling the air decreases its moisture holding capacity and consequently increases its relative humidity. Air conditioned buildings are sometimes kept at too low a temperature during the summer months. In the summer the body becomes accustomed to hot weather and the sudden change in temperature on entering such buildings may be harmful to the health of susceptible persons. In general it may be said that proper



air conditioning is a definite aid in more complete control of indoor air and is conducive to health and efficiency.

### **FRESH AIR DURING SLEEPING HOURS**

Satisfactory ventilation cannot always be achieved during the day. At night, however, during sleeping hours it is possible to obtain good ventilation by the use of sleeping porches or open bedroom windows. A bedroom with cross ventilation is to be preferred to one with a window on but one side. Eight or nine hours of sleep in fresh, cool air counteracts to a certain extent the unsatisfactory ventilation that many people are subjected to during the day. Sleeping in fresh air increases bodily vigor and resistance to disease. Drafts should be avoided and ample covering used to keep the body warm. In very cold weather the room should not be permitted to get too cold or sleep may not be restful.

### **AIR POLLUTION**

The air of cities frequently contains relatively large quantities of smoke, dust and various gases emanating from industrial establishments, motor vehicles and homes. Industrial sources are responsible for the bulk of the pollution. The inhalation of large quantities of soot and dust and certain gases irritates the mucous membrane of the respiratory tract and predisposes to respiratory infection. In cities in which the air is heavily polluted the pneumonia death rate is high, particularly in those sections most heavily contaminated with soot.

The presence of pollen in the air may cause hay fever, asthma or other conditions in susceptible individuals. Other vegetable and animal particles may cause similar reactions. Such susceptibility is known as allergy. Some 3,000,000 persons in the United States suffer from various forms of allergy.

Among the harmful gases, carbon monoxide (CO) is one of the most dangerous. It causes many deaths each year. This gas is odorless and results from the incomplete combustion of organic matter. It is always present in the exhaust of automobile motors and may be given off from heating stoves and furnaces that have insufficient draft. It is present also in cooking gas. On city streets where automobile traffic is heavy the concentration of this gas may be sufficient to be considered a definitely unhealthful factor. Carbon monoxide is lighter than air and will rise into an automobile from a leaky muffler or exhaust heater. In one investigation a large percentage of closed cars tested while in operation were found to contain dangerous concentrations of this gas. It is advisable to keep an



automobile well ventilated while the motor is running. In a small closed garage an automobile engine in operation will give off in a few minutes enough of the gas to cause death. When a person is overcome by the gas his legs become paralyzed, causing him to fall and making it impossible for him to walk or even crawl to safety.

Carbon monoxide exerts its poisonous effect by combining with hemoglobin, the oxygen-carrying compound of the blood, which it converts into a compound (carboxyhemoglobin) incapable of serving as an oxygen carrier. Because the chemical affinity of carbon monoxide for hemoglobin is between 200 and 300 times that of oxygen for hemoglobin, a very small amount in the atmosphere becomes toxic to the body. The presence of 0.01 per cent of carbon monoxide in air is harmful. A concentration of 0.5 to 1 per cent may cause death in two to fifteen minutes. The treatment for carbon monoxide poisoning consists of prompt removal of the victim to fresh air and if breathing has stopped, the administration of artificial respiration. The union of carbon monoxide with hemoglobin is not permanent; if fresh air is breathed oxygen will gradually replace the carbon monoxide. The after-effects of the poisoning may be long-lasting if the victim has breathed much of the gas.

In war there is always the possibility of gas attacks on civilians. Some of the "war gases" are irritants of the upper respiratory tract while others irritate the lungs; some cause blistering of the skin or act as systemic poisons. Examples are mustard gas, phosgene, chloropicrin, lewisite and adamsite.

### CLIMATE AND HEALTH

Climate refers to the characteristic weather conditions, such as temperature, relative humidity, wind, clouds, pressure and precipitation, that prevail over a long period of time in a particular locality or region. Climate has a direct and powerful influence on human life since human activities are, in one way or another, affected by weather and climate. A cool climate with frequent temperature fluctuations is a stimulating climate; it exerts a driving effect on body metabolism, increasing body vitality and energy expenditure. A cool climate in which there are frequent temperature changes and strong winds is particularly stimulating. A cold climate, such as that encountered in arctic regions, may be stimulating to too high a degree; it may drive the body at top speed which may result in mental and physical exhaustion. A warm, humid climate with little air movement has an enervating effect upon the human body. In such a climate heat loss is difficult, energy production is reduced and all



body processes are to some extent depressed. The temperate regions of the earth are best adapted for progressive activity and well-being. Here the expectation of life is greatest and the death rate the lowest.

### HEALTH PRACTICES TO BE ACQUIRED

To adapt oneself satisfactorily to the atmospheric factors of the environment requires the establishment of the following health practices:

1. Develop an appreciation of fresh air.
2. Keep the temperature in the home at approximately 70° F. during the months when artificial heat is needed.
3. Sleep under healthful conditions in a well-ventilated room.
4. Become outdoor-minded and live as much as possible in the open air.

### QUESTIONS FOR CLASS DISCUSSION

1. What is the composition of the atmosphere at the level where man lives?
2. Besides the constant elements, what are the other constituents of air?
3. Why does air exert pressure? What is it equivalent to in pounds?
4. Explain the following terms: (1) barometer, (2) meteorology, (3) troposphere, (4) stratosphere, (5) ionosphere, (6) humidity, (7) absolute humidity, (8) relative humidity, (9) psychrometer and (10) hair hygrometer.
5. What effect does change of temperature have on relative humidity? On absolute humidity?
6. State the two main reasons why air is important to the human body.
7. What are the effects of fresh air on the body?
8. Specify the harmful effects that the air of a poorly ventilated room may produce on the body.
9. What are the factors that give rise to the harmful effects of air?
10. Describe experiments that were made to determine the causes of the ill effects of air?
11. Are decrease in oxygen and increase in carbon dioxide factors in the ill effects of poor ventilation? Explain.
12. What are the underlying factors that make one uncomfortable on a hot, muggy day?
13. Give the essential points concerning healthful ventilation.
14. Why is 68° F. considered the critical indoor temperature?
15. What are the important factors involved in modern air conditioning?
16. Discuss the value of good ventilation to health.
17. What are the benefits derived from sleeping in fresh air?
18. In what ways is smoke a health hazard?
19. Discuss carbon monoxide poisoning.
20. Explain the relation between climate, season and health.
21. Summarize the adjustments man must make to the air in which he lives.

### TOPICS FOR ORAL OR WRITTEN REPORTS

1. Prepare a brief account of the tragedy of the "Black Hole of Calcutta."
2. Discuss one of the following: (a) the respiratory system, (b) hay fever, (c) asthma.



3. Describe the nasal cavities and their connecting sinuses. What is sinusitis?
4. Investigate war gases and their dangers.
5. Make a study of the gas mask and its operation.
6. Visit an air conditioned building and study the equipment. Make a report to the class.

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## CHAPTER 13

### *Sunlight and Health*



THROUGHOUT the ages sunlight has been regarded by man as a factor necessary for his well-being. Many ancient peoples attributed preventive and curative powers to sunlight and some worshipped the sun as the giver of life and health. Hippocrates, the father of scientific medicine, recommended sunlight as a valuable agent in the treatment of disease. Modern man has acquired definite knowledge concerning the nature of sunlight and its influence on the human body.

#### NATURE OF SUNLIGHT

Sunlight is a form of radiant energy transmitted from the sun through space at the rate of more than 186,000 miles per second. Light is transmitted in the form of waves known as electromagnetic waves. The waves are believed to be made up of exceedingly minute particles, but what the particles consist of is not known. Except for their wave lengths, light rays are essentially the same as other electromagnetic waves, among which may be mentioned the radio waves used in radio broadcasting and the cosmic rays in which the wave lengths are exceedingly short. Electromagnetic waves require no material medium for their transmission.

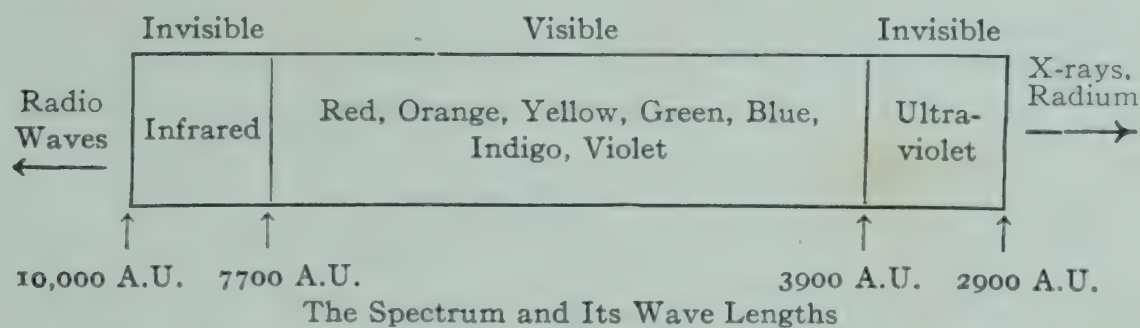
The radiant energy transmitted by the sun, commonly referred to as light, consists of three types of rays: (1) visible rays, which make seeing possible; (2) infrared rays, which furnish most of the heat of sunlight, and (3) ultraviolet rays, which cause sunburn and tanning of the skin. These rays vary in wave length. One of the units used for measuring wave lengths is the Angström unit (A.U.), which is equal to one ten-millionth of a millimeter, or about one-two hundred and fifty thousandths of an inch. The millimicron, which is equal to one millionth of a millimeter, is also used.

The visible rays of sunlight are composed of rays of various wave lengths. This can be demonstrated by passing light through a transparent prism in an instrument known as a spectroscope which separates visible light into its component rays, producing an orderly series of bands of



color, from red to violet, known as the *visible spectrum*. The colors are always arranged in orderly sequence (as those in a rainbow) as follows: red, orange, yellow, green, blue, indigo and violet. Violet rays have the shortest wave lengths while red have the longest. Ultraviolet rays are so called because they lie beyond the violet of the spectrum. They have wave lengths shorter than the visible violet rays, while infrared rays have longer wave lengths than the visible red rays. These various groups of rays are present in sunlight in approximately the following percentages: infrared, 80 per cent; visible rays, 13 per cent; ultraviolet, 7 per cent.

Ultraviolet rays can be divided into three classes on the basis of wave length. These classes are the near, middle and far ultraviolet. The longest or the near ultraviolet rays produce fluorescent (cause certain minerals to glow in the dark) and other photochemical effects, but have little physiologic effect on the human body. The middle ultraviolet rays pro-



duce sunburn and tan and transform certain sterols into vitamin D. The far ultraviolet rays have the shortest wave lengths. Only a few reach the earth since most of them are filtered out by the upper layers of the atmosphere. They are very potent in the destruction of bacteria and other microorganisms. Certain ultraviolet lamps produce chiefly the far ultraviolet rays. Such lamps are used in certain situations to kill microorganisms in the air and on objects. They are used also in the "tenderay" process which hastens the tenderization of beef. The ultraviolet rays that produce physiologic effects on the body are not transmitted through ordinary window glass since they lack penetrating power. They do not readily pass through paper or cloth.

### PHYSIOLOGIC EFFECTS OF SUNLIGHT

The effects produced by sunlight upon the body may be divided into two classes: (1) those produced by infrared rays and (2) those brought about by ultraviolet rays. Infrared rays produce their effects through their heating properties. They raise the temperature of the skin and the tissues immediately beneath the skin. This is accompanied by dilatation of the blood vessels, an increased volume of blood and an increased metabolic rate in the tissues affected.



Ultraviolet rays act on the outermost layers of the skin and give rise to chemical changes in the cells as they pass through them. The chief action of these rays is to bring about the conversion of sterols, which are normally present in the skin, into vitamin D. In young children rickets can be prevented by exposing the body to sunlight or by the administration of vitamin D by mouth. Sunlight increases the amount of pigment (melanin) in the skin and thus causes tanning. After the skin has become well tanned, it is more difficult for ultraviolet rays to penetrate it. Tanning thus serves to shield the body against excessive ultraviolet radiations.

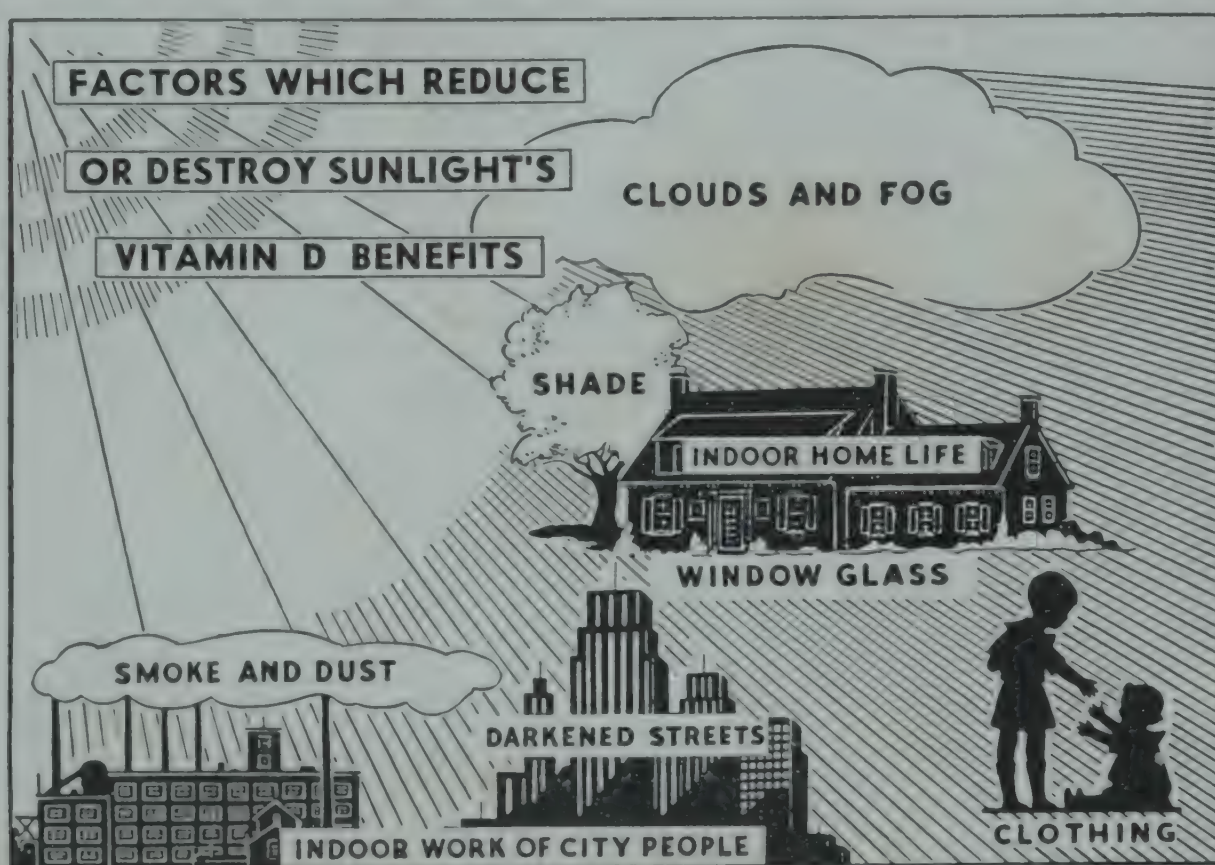


Fig. 35. Factors which reduce or destroy sunlight's vitamin D benefits. (Courtesy of Wisconsin Alumni Research Foundation.)

Blonds and red-haired individuals, as well as some brunettes, do not tan easily. Such persons should be cautious in exposing their skins to sunlight. In debilitated states of health, exposure of the body to sunshine helps to overcome anemia, builds up wasted muscles, stimulates metabolism and exerts a favorable influence on the patient's psychological attitude.

### SUN EXPOSURE

The person who desires to expose his skin to the sun for cosmetic or health reasons should proceed with caution. The untanned skin can tolerate only a limited amount of sunlight at the time of the first exposure. Nature inexorably demands her price for the indiscretion of overexposing the body to the sun. It is inadvisable to linger longer than ten to fifteen minutes the first day under the summer sun. Each day the time of expos-



ure may be increased by ten to fifteen minutes until the desired coat of tan has been acquired. Every precaution should be taken to prevent sunburn. Sunburn is an injury to the skin and is similar in many respects to burns from other causes. It differs from other burns in that there is a latent period before redness and burning are observed. A severe sunburn that covers a large area of the body may endanger life. Sunburns are easily acquired at the beach due to the reflection of ultraviolet rays from the water and sand.

Due to deflection, ultraviolet rays become dispersed and therefore are present also in the shade on a bright day. Thus some of the benefits of sunshine may be obtained without direct exposure to sunlight.

#### **ANTISUNBURN PREPARATIONS**

Preparations are on the market which offer some protection against sunburn. When applied to the skin they filter out and absorb a large percentage of the ultraviolet rays. It has been found that ordinary red petroleum jelly is very effective when used for this purpose. Yellow and white petrolatum are also satisfactory. These preparations are of value in reducing the hazards of too much exposure to sunlight on occasions when an individual may be obliged to spend much time in the sunshine.

#### **INTENSITY OF ULTRAVIOLET RADIATION**

The ultraviolet radiation received from the sun varies with the length of the sunshine period, the latitude, the clearness of the atmosphere and the time of year. Clouds, dust particles, smoke and atmospheric moisture absorb and thus reduce the amount of ultraviolet rays that reach the earth. In large cities the intensity of ultraviolet radiation may be greatly reduced by smoke and dust.

Seasonal variations occur. During midwinter the intensity of ultraviolet radiation is only about 10 per cent of that of midsummer in the northern part of the United States. During the winter when the sun is in the southern portion of its circuit, sunlight falling on the northern hemisphere must pass through a greater distance of the earth's atmosphere, due to the obliquity of the rays. Furthermore, since oblique rays are scattered over a larger area than vertical rays, each square foot of surface receives less light. At high altitudes, because of the clarity of the atmosphere, the amount of ultraviolet radiation is greater than at sea level. Window glass filters out most of the ultraviolet rays.

#### **ARTIFICIAL SUNLIGHT**

Various types of lamps have been constructed to produce certain specific wave lengths of radiant energy. Some emit only those ultraviolet



rays that produce beneficial physiologic effects.<sup>1</sup> Others produce the far ultraviolet rays useful for killing harmful microorganisms. Lamps producing infrared rays are also available. Such lamps must be used with caution and should be used in the treatment of disease only upon the advice of a physician.

### THERAPEUTIC USES OF SUNLIGHT

Sunlight now has a definite place in modern medicine as a valuable agent or adjunct in the treatment of certain human ills. The therapeutic

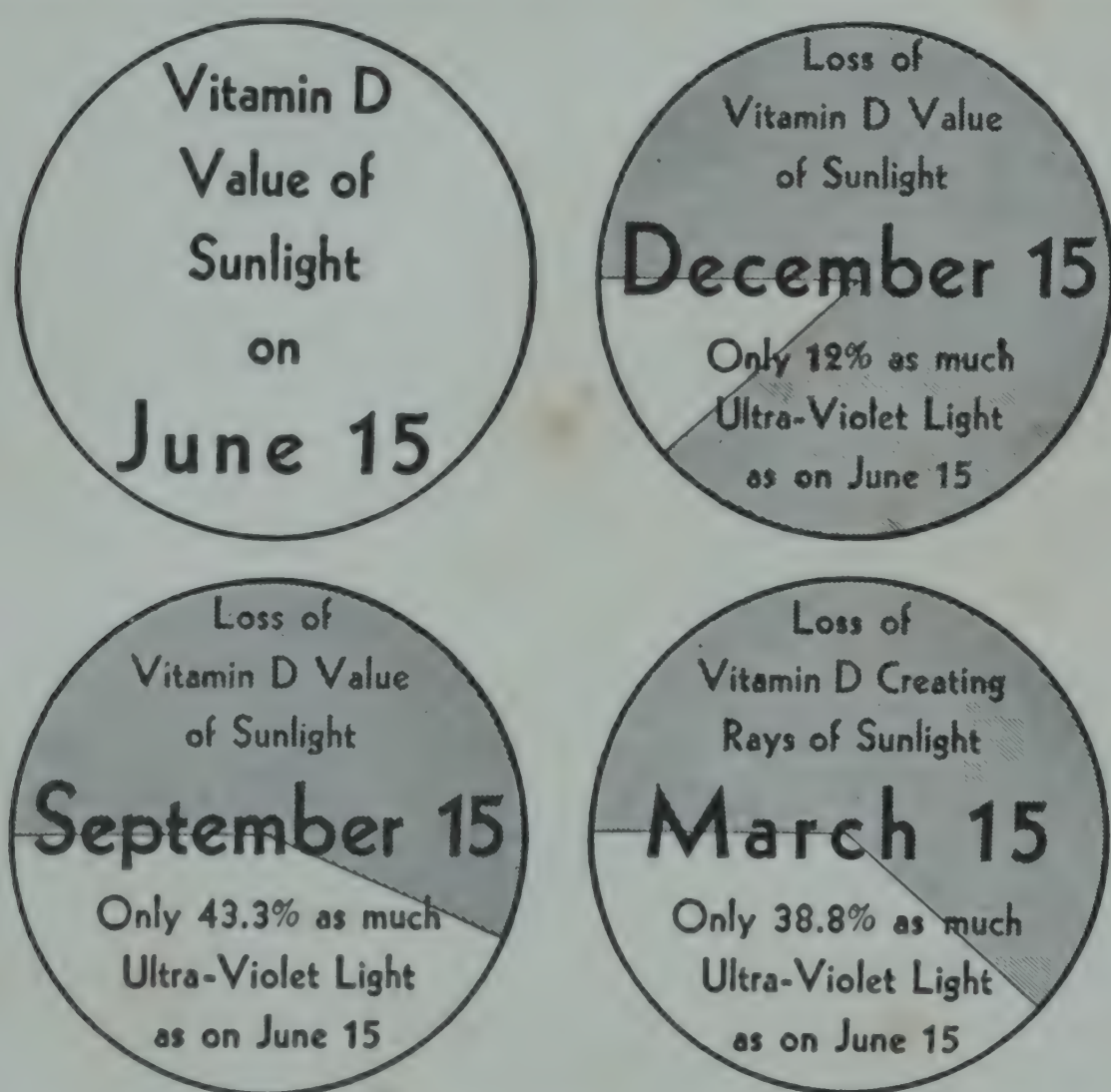


Fig. 36. Seasonal variations in ultraviolet intensity. Based on Laurens, "Physiological Effects of Radiant Energy." Data applies specifically to Baltimore, Md., generally to other cities. (Courtesy of Wisconsin Alumni Research Foundation.)

use of sunlight is sometimes called *heliotherapy*. A course of several months' treatment is usually necessary to produce beneficial or curative effects. The duration of the exposure must be adjusted to suit the individual.

Certain skin diseases respond favorably to treatment with sunlight. Sun treatment is an excellent tonic during convalescence from acute in-

<sup>1</sup> Information concerning suitable ultraviolet lamps for use in the home may be obtained from the Council on Physical Therapy of the American Medical Association, 535 North Dearborn St., Chicago, Ill.



fectious diseases. It is a specific cure for rickets and is used with success in treating tuberculosis of the bones, joints and glands. For tuberculosis of the lungs sun treatments are usually not recommended. Treatment with infrared rays is helpful where heat is needed in the interior of the body, as, for example, in cases of muscle, joint or nerve inflammation and for the relief of various aches and pains. The infrared band may be divided into short (near) and long (far) rays. Lamps producing the short infrared rays are the ones generally used; the 250-watt infrared bulbs that fit into ordinary light sockets produce largely short infrared rays. The short infrared rays have greater penetrating power and are less likely to cause burning and blistering.

### HEALTH PRACTICES TO BE ACQUIRED

Since properly regulated exposure of the human body to sunlight offers concrete benefits, it is advisable for every normal person to get his share of sunshine and outdoor life. It is important, however, to keep in mind the fact that sunshine is capable of becoming a painful or even dangerous hazard and to avoid the indiscretion, so commonly committed, of over-exposing the untanned skin to sunlight. Those individuals who have little opportunity to be out of doors may be benefited by using vitamin D milk or by supplementing the dietary with one of the fish liver oils.

### QUESTIONS FOR CLASS DISCUSSION

1. Explain the nature of sunlight.
2. Explain: (a) infrared rays, (b) visible rays, (c) ultraviolet rays.
3. What is the visible spectrum?
4. Give the important physiologic effects of sunlight upon the body.
5. Describe the proper procedure for sun bathing.
6. What factors bring about variations in the amount of ultraviolet rays present in sunlight?
7. How may artificial sunlight be produced?
8. Give the therapeutic uses of sunlight.
9. Summarize the health practices one should acquire in relation to sunlight.

### TOPICS FOR ORAL OR WRITTEN REPORTS

1. Make a study of the work of Dr. Rollier of Switzerland in regard to the treatment of tuberculosis with sunlight.
2. Outline a program of living that will provide the exposure to sunlight that you need.

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## CHAPTER 14

### *Health of the Mind*

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TO BE in good health requires a sound mind as well as a sound body. The health of the mind and that of the body are intimately associated. Although the terms “body” and “mind” are frequently used to designate two separate entities, there is no clear-cut line of demarcation between the body of man and his mind. Man functions as a whole, not as two separate parts, body and mind. He is an integrated mechanism, a psychosomatic unit (body-mind unit). Mind is a function of the body. The brain is necessary to the mind but it does not constitute it; many other body parts are intimately concerned with mental functions. The human organism reacts as a whole, i.e., as a total organism, to the various situations of life.

Since a human being is a body-mind unit, mental health involves physical as well as psychic factors. Included in the physical factors are bodily exercise, correct posture, proper food, fresh air and all other measures necessary for the normal functioning of body organs. The psychic factors include chiefly the control of the emotions and thoughts, and the acquiring of suitable mental attitudes and habits. In this chapter the psychic factors will be considered.

Mental illness has become a problem of great urgency. Many individuals are unable to cope with the problems of modern life chiefly because they have acquired faulty patterns of living and faulty attitudes toward life. It has been estimated that about 8,000,000 of our people are suffering from some form of mental illness. Nearly one-half of the hospital beds in the United States are occupied by patients suffering from advanced stages of mental and nervous disorders. They number more than 600,000. Many more are sufficiently disabled by mental ailments to warrant hospitalization.

Many persons suffer from relatively minor emotional problems which in a greater or less degree handicap them in the conduct of their daily lives. A large percentage of patients who consult doctors have complaints due wholly or in part to emotional disorders. Many cases of functional disorders of the stomach, heart and other structures result from emo-

tional and mental disturbances. Lack of proper mental adjustment to life plays a predominant role in the crimes committed yearly in the United States, in the children under eighteen who are sent to juvenile courts each year, in the cases of chronic alcoholism and in the large number of divorces granted annually.

The prevalence of mental illness emphasizes the importance of mental hygiene. A regard for its teachings is essential not merely as a preventive of mental disorders but for the attainment of a high level of well-being, permitting the individual to live contentedly and happily.

MOTIVATION OF HUMAN BEHAVIOR

Human behavior is motivated by desires which call for satisfaction. These desires or needs serve as drives urging man on to action. The motives at the basis of human action may be primary (physiological), such as hunger and thirst, or secondary (emotional) as fear, anger, grief, elation and love.

An emotion may be defined as a feeling or state of mind accompanied by a sense of pleasantness or unpleasantness. The basic emotions are fear, anger, grief, elation and love. There are other states of mind which are mixtures or extensions of the basic emotions; examples of these are hate, anxiety, worry, admiration, contempt, gratitude and jealousy.

Emotions are commonly revealed through facial and bodily expression as well as by inflection and quality of voice. This is indicated by some of our commonly used phrases, such as "all aglow with pleasures," "paralyzed with fear," "overcome with joy," and "prostrated with grief." Internal as well as external bodily changes occur. It is possible, however, for an individual to mask his emotions so that their presence is not revealed.

Unpleasant emotions, although necessary in human life, may be detrimental to health if not properly controlled or dispelled. They may disturb the vital functions of the body and produce a state of unrest which may lead to discouragement and despair. If long continued they may have far-reaching effects. If, however, proper action follows the experiencing of the emotion, the individual is relieved of the mental stress and the vital organs resume their normal functions. Unpleasant emotions are often of value to man. The emotion of anger, for example, if properly controlled, can lead an individual to fight against adverse circumstances and thus overcome obstacles in the path of success. Pleasant emotions tend to exert beneficial effects. They stimulate physical activity and body metabolism and produce a sense of well-being. If excessive, however, they may become exhausting.

The pleasant emotions engendered by the drama, novels, music, the beauties of nature and works of art stimulate the imagination, make for ambition and right living, and encourage one to attain higher levels of achievement. In other words they serve as a stimulus to constructive action. In the words of David Seabury,¹ "Animated by stirring emotion, we feel the impulses which made Michelangelo, Beethoven, Browning and Lincoln."

FULFILLMENT OF HUMAN NEEDS

Man is continuously striving to achieve fulfillment of his needs. Much of human behavior can be explained in terms of satisfying four important needs: (1) the need for a feeling of security, (2) the need for achievement, (3) the need for social approval and (4) the need for physical satisfactions.

A feeling of security in respect to his needs (physiologic, social and economic) is a basic requirement for every individual. Since absolute security is unattainable, some insecurity is inevitable in the life of everyone. Too much security may be detrimental to the progress of the individual, but a high degree of insecurity may have a demoralizing effect.

Every individual requires the satisfaction that comes from successful achievement. It gives him a sense of personal worth. It is important that the goals the individual sets for himself be attainable, and that they be in line with the abilities he possesses. The average individual, however, will not be successful in all of his ventures. An emotionally stable person will adjust himself to situations he cannot master. Those who are unable to adjust to failures or continuously attempt tasks that lie beyond their capabilities will add failure to failure and frustration to frustration. This course leads to mental disorders.

A person requires not only successful achievements but also the recognition of his achievements by others. Everyone is to a large extent dependent upon what others think of him. Social approval is needed to bolster the individual's feeling of importance.

The physiologic needs of an individual must, of course, be satisfied. Inadequate satisfaction adversely influences behavior. Behavior, being a psychological factor, in turn influences adversely his physiological state.

MENTAL CONFLICTS

In the life of modern man mental conflicts are continually arising. Many are of a minor nature, others are of major importance. When two equally strong drives are mutually irreconcilable, or when our desires

¹ "Unmasking Our Minds," by David Seabury (Boni & Liveright).

are at odds with the demands of our social order, mental conflicts occur. Civilization has placed many inhibitions about us, in the form of customs and tradition, some of which may run counter to our primitive drives. To adjust ourselves properly to modern life, our desires must be coordinated with the welfare of society, our primitive appetites and longings brought under control. Major mental conflicts frequently occur between the primitive urges of man and the inhibitions to human behavior laid down by the social order of which he is a part. Examples of such conflicts are those between the sex urge and morality, anger and social restrictions on its expression, fear and duty, family loyalty and patriotism. The individual, as well as society, gains when emotional expression is so directed that important values rather than the satisfaction of immediate whims will be attained.

Conflicts cause emotional tension. An adequate solution of each conflict is essential, especially if the conflict is of considerable significance to the individual. If it is solved in a satisfactory manner, a definite course of action can be taken, and the emotional tension relieved. To solve a conflict it is necessary to face the situation frankly, make a decision and formulate a plan of action. If the conflict is between two incompatible drives the individual must make a clear-cut decision between the two and adhere to his decision. If the conflict is caused by a desire that is not in accord with the customs and demands of one's social group, it is necessary to reconcile the emotional urge with the world of reality.

In many cases an indirect outlet, such as a constructive plan to prevent the recurrence of the situation that gave rise to the conflict, or a determination to learn a lesson from the situation and benefit thereby, will serve as a suitable solution. When an emotional drive is thus directed into a channel that is socially beneficial it is said to be *sublimated*. Sublimation enables the individual to release energy which unreleased would produce emotional tension. Failure to resolve a conflict leads to frustration. Improper solution of major conflicts may cause serious functional nervous disorders. Much human misery and neurotic illness is due to inadequate solution of inner conflicts. Many of the mental illnesses of later life have their origin in the conflicts, fears, anxieties and frustrations of childhood. Individuals who do not satisfactorily resolve their inner conflicts may when exposed to environmental stress develop symptoms of functional mental illness.

CONTROLLING EMOTIONAL RESPONSES

Emotional responses, whether associated with mental conflicts or not, can be controlled and directed. Emotions, both pleasant and unpleasant,

serve as stimuli to action; they supply the drives for our activities. Although they play a necessary role in our lives, unpleasant emotions may produce abnormal effects on the body and the personality if improperly controlled or dispelled. They may disturb the functioning of the body by bringing about a loss of appetite, indigestion or irregularities in heart action. The mind is kept in a state of unrest. If proper action follows the experiencing of the emotion the mental stress disappears and the body functions revert to normal. Long continued emotional stress may give rise to serious behavior disorders.

An emotion is controlled by directing its use, not by denying it expression. Responding to an unpleasant emotion by attempting to put it out of consciousness is known as *repression*. An emotion is a stimulus to action. Undesirable action should not be permitted but the emotion must not be repressed. It should be given expression in a realistic and reasonable manner. Repression creates tension, expression relieves tension. Repression may work satisfactorily with minor unpleasant emotions but when applied to a major emotional disturbance it is not a solution because the emotion will not remain suppressed but will keep the individual in a state of emotional upset. The resulting emotional upset, if long continued, may result in physical symptoms, such as functional disturbances of the heart and the gastrointestinal tract, or mental disorders including insanity.

Petty Annoyances. Trivial, irritating situations and unpleasant incidents are frequent occurrences in the life of everyone. Usually nothing can be done to prevent their recurrence and the best procedure, therefore, is to train the mind instantly to brush them aside. A person who has a sense of proportion, enabling him to differentiate between important and unimportant matters, disregards minor irritations and thereby escapes emotional disturbances from inconsequential incidents. The more significant unpleasant emotional disturbances, however, must be handled by finding suitable outlets for the emotional urge.

Fear and Anxiety. Because there are factors in our environment that offer actual or potential danger, a sense of fear and anxiety is essential in that it enables us to take the necessary precautions to keep us out of danger. Fear is related to the present; it is temporary and is not prolonged beyond the stage of usefulness. Anxiety, a form of fear, is a state of uneasiness about the future. No person can go through life without experiencing anxiety. Without anxious concern over the present and future we could not meet the demands of civilized living. An abnormal or chronic anxiety is commonly known as "worry."

Worry is an undesirable state of mind. It places the person who engages in it under considerable nervous tension and acts as a depressant to normal mental functions, yet it accomplishes nothing for the individual. Uncontrolled worry leads to physical as well as mental illness. Many people resort to worrying without definitely knowing what it is that is causing their anxiety.

To break the habit of worrying it is necessary to determine what is causing it and to separate the real cause from imaginary ones. Bringing the underlying factors into the open will smooth the way for a more realistic and reasonable attitude toward the situation. The application of reason may yield a solution and lead to a suitable form of action. Thus the tension is released and emotional stability is regained.

Hypochondriasis. This term refers to fears concerning one's health. The hypochondriac has a morbid anxiety about his health. He magnifies every ache and pain and minor ailment and is constantly worried because he fears that they signify serious disease. He is the victim of fears. No one should turn his attention too strongly on the inner workings of the body. Constant introspection is a bad mental habit that interferes with body processes. The body works best when the important physiologic functions are not brought into consciousness. Digestion, for example, is carried on better if one has no apprehensions about it.

Daydreaming. Daydreaming is a form of emotional response whereby the individual's desires are satisfied in a world of fantasy rather than in the world of reality. Everyone resorts to daydreaming but some do so more than others. It may have either beneficial or harmful effects. Daydreaming cannot take the place of genuine satisfaction but it may soften disappointments by providing temporary escapes from unpleasant experiences. If it sets goals toward which to strive and furnishes clues as how best to attain these goals, daydreaming may be an incentive to actual achievement. Imaginary success, like actual success, may give impetus to desirable activity.

When indulgence in daydreaming decreases actual performance it is detrimental. Daydreams that deal with the impracticable and impossible may be harmful if frequently resorted to. Such dreams engender procrastination or may lead to efforts in wrong directions. It is easy to drift into the world of dreamy meditation. A person who devotes much of his time to fantastic daydreaming may lose the ability to face the world of reality properly. He becomes progressively less able to cope with the real situations of life and may have difficulty in differentiating between the real and the unreal.

EMOTIONAL STABILITY

The person who meets each situation objectively without undue emotional stress and formulates plans of action based on his best judgment is emotionally stable. He gives rein to his emotions in a realistic and normal manner. An emotionally unstable person overacts to every stimulus. He makes major problems out of minor incidents and permits his emotions to interfere with his judgment. A person of whom it may be said that "everything gets on his nerves" is suffering from emotional instability. He has failed to acquire the technic of controlling his emotional responses.

Some adults never attain emotional maturity but remain on a childlike level in their emotional responses. Emotional maturity is manifested by such qualities as tenacity of purpose, dependability, cooperativeness and an inner drive to work and sacrifice for long-term values.

HEALTHFUL MENTAL ATTITUDES

Mental attitudes are extremely significant. What a person becomes in life depends largely upon the attitudes he acquires. Attitudes are learned reactions to life, and can, therefore, be modified by unlearning and relearning. Healthful attitudes can be attained by training the mind into definite modes of reaction to situations. Agreeable states of mind make for health. The attitudes we take toward things or situations are more important than the things or situations themselves.

Interest in Life. To live happily it is essential to take an interest in life. Sole preoccupation with one's self is too small a subject to satisfy the human mind. There is much to hold our attention in the drama of life ceaselessly in progress on the stage of the world about us. We ourselves are actors in, as well as observers of, this spectacle of life. The opportunity of a journey through life is given to us but once. In the short time allotted to a human being to sojourn on this earth it is impossible for him to delve into all of the interesting phases of his immediate and remote environment. Modern man has at his disposal the rich heritage of the race in the domain of literature, music, art, science, technology and all the amenities that ennoble life. An important source of human happiness lies in the enjoyment attainable through the recognition of the beauties of nature. It is true that there is much in life that is sordid and ugly, but one must face the whole picture and not be mentally submerged by the disheartening situations that exist.

Self-Reliance and Courage. Having faith in one's self and being

able to rely on one's own judgment are human traits that are essential for effective living. A self-reliant person meets his problems and solves them to the best of his ability. Self-reliance is not a gift, it is a cultivated attitude, a technic which is acquired and perfected through practice.

It should not be assumed that a self-reliant person is free from feelings of inadequacy. Due to individual differences human beings vary considerably in their abilities. Every person has limitations and handicaps. The sense of inadequacy is universal. A moderate feeling of inadequacy may be beneficial rather than harmful in that it may furnish the drive for successful achievement. However, a person who harbors strong feelings of inferiority is allowing himself to be defeated.

It is usually possible for a person to compensate for his deficiencies by building up his assets. Every person should give more attention to his assets than to his shortcomings. It is essential also that the individual recognize both his capacities and his limitations so that he may set goals for himself that are attainable. It is, of course, desirable for a person to try to improve himself, but he must keep his goals within reach. One is foredoomed to defeat if one attempts to excel in a field in which one has little ability.

A feeling of inferiority is often associated with high intelligence and is not necessarily due to actual inferiority. Some people perpetually feel inadequate regardless of how others may evaluate their worth and regardless also of their own intellectual evaluation of themselves. To overcome this feeling toward himself it is necessary to probe into the past life of the individual to determine the cause of the feeling. If this can be accomplished the situation can then be faced and overcome. It is inadvisable to entertain strong feelings of inferiority since they may hamper the person in the use of his assets and thus keep him from developing the potentialities for success that he may possess.

Some persons assume an air of self-importance. This is an immature attitude. In human life as well as in art, it is essential to maintain balance and proportion. Men of real worth are usually modest and humble, yet they possess what may be referred to as a victorious attitude toward life.

To take proper action concerning the problems of life calls for courage. It, too, is an acquired attitude, generally attainable by everyone. Courage is a practical technic that enables a person to come to grips with reality and put his decisions into action. Facing reality squarely is fundamental to mental health. It is only when a person comes to terms with reality that he can fulfill in an adequate manner his personal and social responsibilities.

Self-respect. A basic requirement of sound mental health is self-respect. A well-adjusted person is cognizant of the fact that he is an accepted member of a social group and that he is liked by the members of the group. He in turn likes the members of the group. Persons who are maladjusted usually have a strong dislike for themselves. Loss of self-respect is an underlying factor in many cases of emotional disorders.

Tolerance and Understanding. One of the attributes of a well-adjusted mind is tolerance toward others and tolerance for the opinions of others. People differ in their abilities, talents, actions, feelings and beliefs. Some belong to different racial groups than others. People differ also in their social, economic, political and religious convictions. In regard to these points, man has not yet found a way of determining which are the right conceptions in these fields. The term "truth" represents a relative concept. Man does not yet have sufficient insight into the intricacies of the world and the universe, nor into his own nature, to claim that he is in possession of absolute truth. Since truth is relative, the only intelligent attitude a person can take in regard to his opinions is to consider them as being tentative.

Mental health requires an attitude of fairness and open mindedness toward other people, including their opinions and beliefs. It is unwise to permit ourselves to feel tense and irritated when we come in contact with opinions at variance with our own. If we are not tolerant we become irritated, emotionally upset—and to no purpose.

A spirit of tolerance and understanding enables us to get along with people whether or not they see eye to eye with us. In our daily life we are likely to come in contact with persons who are antagonistic, arrogant and discourteous. If we look beneath the surface for the cause behind these traits we may find that they serve as a cloak to hide an overwhelming sense of inferiority. A person who has acquired the technic of understanding and getting along with people will not be subject to tension and irritation as he comes in contact with poorly adjusted personalities, nor will he be unfair in his relationships with his fellow beings. The Golden Rule, "Do unto others as you would have them do unto you," is good mental hygiene.

DIRECTED THINKING

To learn to regulate, control and direct one's thinking is a necessary part of healthful living. By our thinking we form ideas and reach conclusions. Directed thinking helps us to act purposefully and to meet the situations of life in a satisfactory manner. Thinking is an intellectual

technic which can be acquired and developed. Much so-called "thinking" is chiefly emotional in nature. To be of value, the process of thinking and reasoning should be objective; that is, it should be based on facts, not wishes or fears. By intellectually objective methods, facts as they actually exist can be faced, situations analyzed and logical conclusions can be reached. By this technic we form judgments concerning what we should do to meet the situations which confront us. This kind of thinking helps us to act purposefully concerning the situations of life, and thus make a more satisfactory adjustment to life. The oftener one resorts to the process of objective reasoning (problem solving) the more perfect will one's technic become.

A PHILOSOPHICAL VIEW OF LIFE

The term "philosophy of life" refers to a code of values or guiding principles by which a person directs his life. Everyone needs a realistic philosophy, a code of values that becomes a part of the fabric of his life. It helps him to see life as a whole, to view incidents with perspective and in proper proportion, and gives meaning to his efforts. A suitable philosophy of life helps one to meet disappointment and defeat and to face the future without undue fear. It helps one also to endure evils which cannot be remedied. Many persons, unfortunately, have failed to acquire a philosophical view of life. Lacking guiding principles they are unable to maintain their mental balance when they meet with the inevitable frustrations of life.

Standards of conduct, or ideals, are usually closely associated with a realistic philosophy. Constructive ideals increase the individual's estimate of his own worth and possibilities. Working toward his ideals helps him to sustain his courage and his enthusiasm toward life. Life is not static, it is a process of development and growth. As ideals are approached new ones evolve and thus life increases in significance. In the words of Carl Schurz, "Ideals are like stars—you will not succeed in touching them with your hands, but like the seafaring man on the desert of water, you choose them as your guides, and, following them, you read your destiny."

A SENSE OF HUMOR

A sense of humor helps one to gain relief from the tenseness of life since it enables one to give ideas a fantastic or ludicrous turn and thus to promote gaiety and mirth. It promotes optimism and keeps one from considering too seriously the realities of existence. Without it the spectacle

of life becomes a tragedy. A sense of humor diverts the mind from the humdrum affairs of life and helps us to live contentedly and happily. As expressed by Ralph Waldo Emerson, "The perception of the ludicrous is a pledge of sanity. A rogue alive to the ludicrous is still convertible."

RELATION OF WORK TO MENTAL HEALTH

Work is a powerful factor in maintaining the health of the mind. It affords an outlet for man's innate desire for achievement, furnishes an opportunity for self-expression, provides ideas for the mind and keeps his thoughts from constantly turning onto himself. Through his work man fulfills his obligations to the social order of which he is a member.

Acquiring an education is a very important kind of work. Training the intellectual faculties has become an important human need. Raising the level of intelligence is extremely important in the world as it is now constituted. Knowledge helps man to evaluate the relative importance of things. Without knowledge and intelligence it will become increasingly more difficult for people to adapt themselves to the highly complex economic and social structure that characterizes the modern world. As stated by Winston Churchill: "The future of the world is left to highly educated races who alone can handle the scientific apparatus necessary for preeminence in peace or survival in war. I hope our education will become broader and more liberal. All wisdom is not new wisdom and the past should be studied if the future is to be successfully encountered."

To do effective mental work, concentration of attention is an important factor. The ability to apply one's mind steadily and exclusively to one subject at a time is essential for successful mental development and growth, and for successful achievement. Concentration of attention is a habit that can be acquired by conscientious practice. The only way the mind can be developed and knowledge acquired is through hard mental work. The mental faculties deteriorate if they are not put to use.

ABNORMAL MENTAL FUNCTIONING

Failure to develop suitable mental habits and properly to control one's mental life may lead to functional nervous disorders. The ordinary exigencies of life may give rise to deep emotional conflicts in individuals who have not properly adjusted themselves mentally to their surroundings. Such mental conflicts may result in mental disease. The difference between normal and abnormal mental functioning is largely one of adjustment to the conditions of life.

Mental abnormalities assume many forms and vary in degree from minor mental aberrations to serious behavior disorders. The number of people afflicted with minor types of mental disturbance is very large. The more serious mental disorders may be divided into two main groups, namely, those called *psychoneuroses* or *neuroses*, and the *psychoses*. A psychoneurosis or neurosis is a behavior disorder in which the symptoms are sufficiently pronounced to handicap the individual greatly but are not severe enough to cause him to be hospitalized. A psychosis is a severe behavior disorder warranting the hospitalization of the patient. A person suffering from a psychosis is commonly referred to as being insane.

Among college students the incidence of behavior disorders is somewhat less than is found in young people in the general population. Many college students experience temporary maladjustments that require psychiatric treatment. A somewhat smaller group exhibits psychoneurotic symptoms and a relatively small group suffers from some form of psychosis.

PSYCHONEUROSES

The psychoneuroses include such forms of mental unbalance as *hysteria*, *obsessions*, *compulsions*, *phobias*, *neurasthenia* and a condition known as *psychopathic personality*.

Hysteria. Hysteria is a behavior disorder that gives rise to functional disturbances of body organs. Psychological conflicts are converted into physical symptoms. It is a reaction to frustration by aggression against the self. The symptoms simulate organic disease such as functional paralysis, deafness, blindness or partial loss of memory. The organ or organs affected show no pathologic conditions. The symptoms, however, are not the result of conscious design but they enable the individual to evade unpleasant reality. A person afflicted, for example, with hysterical paralysis of the legs is unable to walk although no structural damage is present in the muscles, nerves, blood vessels or other parts of the legs.

Obsessions and Compulsions. An obsession is the persistent recurrence of an idea which cannot be reasoned away. It is extremely annoying to the patient because it compels his attention to the exclusion of other ideas or thoughts. Because his attempts to rid himself of the idea are unsuccessful he feels dominated by it. It may dominate him so completely that he can no longer perform his daily tasks.

An obsession that compels action is known as a compulsion. This carries with it the overpowering impulse to the repetition of some act.

Examples of compulsions are the so-called "manias," such as the mania to steal (kleptomania), to count (arithmomania), to set fires (pyromania) and the urge to kill (homicidal mania).

Phobias. A phobia is a violent uncontrollable fear of objects or situations which are not adequate cause for fear. About twenty-seven kinds of phobias have been listed. Examples of phobias are fear of being confined in a small space (claustrophobia), fear of open spaces (agoraphobia), fear of high places (acrophobia), fear of darkness (nyctophobia), fear of speaking aloud (phonophobia) and fear of animals (zoophobia).

Neurasthenia. Neurasthenia, commonly called nervous breakdown, is a condition of emotional conflict characterized by nervous exhaustion and fatigue. The patient is irritable and unable to concentrate his attention. It is brought about by anxiety states which arise when one is driven by circumstances to take some action when confronted with a problem but is unable to find a way of doing so.

Psychopathic Personality. This term applies to persons who are seriously maladjusted but do not exhibit symptoms that permit them to be placed in any of the well-defined categories of mental abnormality. These individuals usually show lack of emotional maturity, are unwilling to assume responsibility, possess socially antagonistic traits and may be sexually perverted.

PSYCHOSES

Psychoses may be organic or functional. Organic psychoses are so called because they have a definite physical basis. Among these are the psychoses due to deterioration of the brain with age. *General paresis* is an organic psychosis due to damage to the brain by the germs of syphilis.

The functional psychoses exhibit no observable physical basis. They are considered to represent maladjustments, i.e., acquired behavior patterns. There is also the probability that some underlying organic condition is a contributing factor in some cases. The functional psychoses are usually classified into three groups, *schizophrenia*, *paranoia* and *manic-depressive psychosis*.

Schizophrenia. The term schizophrenia, meaning "split personality," is appropriate because this type of mental derangement is characterized by a disorganization of the personality. It occurs chiefly in adolescents and young adults. The schizophrenic is unable to make normal adjustments to his environment. He has lost interest in the normal activities of life, gives up trying to be a part of the society in which he lives and with-

draws mentally into a dream world of his own creation. Children who are introverted and have little ability to make good social adaptations are prone to become schizophrenics. They retreat from problems rather than adjust to them. If proper guidance is given in the early stage of the condition, there is a good chance that its course may be arrested. About 80 per cent of the schizophrenics entering mental hospitals remain there the rest of their lives; consequently the number of these patients in relation to those hospitalized for other types of mental disorders is very large. This does not mean, however, that a large percentage of the general population acquires schizophrenia. The actual number is less than 1 per cent (about 85 for every 10,000) of our people.

Psychiatrists have divided schizophrenia into the following types on the basis of the preponderance of certain symptoms: simple, hebephrenic, paranoid and catatonic.

The simple form of schizophrenia is characterized by lack of interest and energy. The individual is relatively indifferent to his surroundings, living almost completely within himself. The condition develops very gradually and in advanced cases the patient shows complete apathy to events outside his private dream world.

The hebephrenic type is characterized by a rapid decline to a childish type of behavior. A child who later develops hebephrenia is usually intensely shut-in, lacks initiative and is highly imaginative. The hebephrenic individual lives almost completely in an imaginary world within himself. He frequently hears voices which may tell him pleasant things or they berate him.

In the paranoid type of schizophrenia the individual is not so shut-in as those afflicted with the other types. It appears somewhat later in life than do the other types. The victim is a jealous personality, is suspicious of everyone, and blames others for the troubles he experiences and for his failures. The condition is characterized by delusions of persecution and of grandeur. His delusions of grandeur may convince him that he is an exceedingly important personality. He usually experiences hallucinations—most often, the hearing of voices.

The catatonic type is characterized by periods of stupor in which the patient may lie immobile for days, weeks or months. He may stuff his ears with cotton and keep his eyes tightly closed in order to shut off all external stimuli. Periods of stuporous depression may alternate with periods of excitement in which he may become violent.

Manic-depressive Psychosis. In this type of psychosis the patient usually experiences two separate and distinct phases, one designated as

the *manic*, and the other as the *depressive* phase. When in the manic phase, the patient is exceedingly active physically, mentally and emotionally, whereas in the depressive phase he is discouraged and sad, and may become so unresponsive that he sinks into a stupor. During periods of remission the patient reacts in a normal manner. In some individuals the manic attacks are short and mild, in others they may extend over a period as long as six months. The depressive phase may not occur in some patients or it may be very mild and transitory.

Some persons have only one attack of this type of psychosis, remaining normal the rest of their lives. Most patients recover. Proper psychiatric treatment will facilitate recovery. When the first attack occurs in adolescence the outlook is less favorable.

Paranoia. Paranoia differs from the paranoid type of schizophrenia in that the delusions of persecution and grandeur are systematized to a high degree and the patient usually does not lose contact with reality. Persons who develop paranoia are of high intelligence and are exceedingly ambitious. They set their goals so high that they inevitably fail to reach them. They blame others for their failures and develop feelings of resentment toward them. Paranoiacs often escape detection since they are usually able to attend to their daily duties. They imagine that they are being persecuted which may prompt them to commit murder. There are persons who have a paranoid trend but remain sufficiently well adapted to forestall the development of paranoia.

PSYCHOTHERAPY

Psychotherapy is concerned with the treatment of functional mental disorders by psychological means. By psychotherapy the patients' attitudes are modified so that they will take a more healthful direction and thus help the patients to make a more satisfactory adjustment to their environment. A practitioner of this healing art is known as a psychiatrist. Many people need psychiatric help. Among college students about 10 per cent need the help of a psychiatrist due to some difficulty in interpersonal relationships or adjustment to their environment, which temporarily incapacitates them. The psychiatrist attempts to bring the underlying conflicts to the surface so that they may be viewed objectively in the light of clear thinking. Human beings have remarkable powers of adaptation if they understand the situations they face and realize their significance. However, it is impossible to make a good adaptation to a

situation one does not understand, or a situation one fears or hates yet does not know why it is feared or hated.

Recovery from a psychoneurosis is usually possible with the aid of psychotherapy if the patient cooperates well with the psychiatrist. Early treatment produces the best results. Various forms of physical treatment are sometimes used as adjuncts of psychotherapy. One of these is shock therapy in which the patient is given a severe shock with insulin or metrazol, or by passing an electric current of very low amperage through his brain. The treatment is very rigorous but is of great value in the early stages of schizophrenia, in manic-depressive psychosis and the mental depression (involutional melancholia) which sometimes afflicts persons of middle and old age. Mental institutions can restore approximately a third of their patients to a reasonably normal life.

Mental hygiene and child guidance clinics have been established in many communities. Through their services many persons with mild mental disorders can get help to such a degree that they may never require institutional care.

False notions of mental ailments are responsible for much unhappiness to the families of patients and are harmful to the patients. A mental disorder should not be looked upon as a disgrace, and there should be no stigma attached to a person who requires psychiatric treatment.

✓ HEALTH PRACTICES TO BE ACQUIRED

To maintain and improve the health and efficiency of the mind requires the cultivation of mental habits that will enable the individual properly to adjust himself to the complex environment of modern life. The following health practices are of utmost importance:

1. Acquire the technic of controlling and directing your emotional responses so that they will lead to constructive action.

2. Do not permit yourself to become emotionally disturbed by inconsequential incidents.

3. Conquer your fears so that you will not become a victim of unnecessary anxieties.

4. Acquire the habit of facing reality squarely.

5. Cultivate an attitude of interest toward life.

6. Acquire faith in yourself and courage that will enable you to take proper action concerning the problems of life.

7. Cultivate a spirit of tolerance and understanding of others.

8. Learn to regulate, control and direct your thinking.

9. Formulate a realistic philosophical interpretation of life.
10. Relieve the tension of your life by cultivating a sense of humor.
11. Acquire the habit of concentrating attention.

QUESTIONS FOR CLASS DISCUSSION

1. What is meant by the statement that man is a psychosomatic unit?
2. Besides physical factors what psychic factors are important in maintaining mental health?
3. How prevalent is mental illness?
4. What motivates human behavior?
5. What is an emotion? Give examples.
6. How do emotions affect body and mind?
7. How do pleasant emotions compare with unpleasant emotions in their effect on the body?
8. Name and discuss the four important needs of human beings.
9. What are mental conflicts? How do they arise?
10. Why is it important for the individual to find solutions for his mental conflicts?
11. How may emotional responses be controlled and directed?
12. Explain why an emotion should have an outlet.
13. Why is it harmful to repress an emotion?
14. What is the best manner of handling the petty annoyances of daily life?
15. Discuss fear and anxiety. How may one break the habit of worrying?
16. If you have any unreasonable fears, make a list of them and try to determine how they may have been formed in your early life.
17. What is hypochondriasis?
18. Discuss daydreaming and its bearing on mental health.
19. Explain why a deep interest in life is of value to mental health.
20. Of what value are self-reliance and courage? Can they be acquired?
21. Why is it important that we recognize both our capacities and our limitations?
22. What are the usual end results when a person sets goals for himself that are unattainable?
23. Why is it inadvisable to entertain strong feelings of inferiority? How may a person overcome this attitude toward himself?
24. Of what importance is self-respect to mental health?
25. Should one assume an air of self-importance? Explain your answer.
26. From the standpoint of mental health, why should one cultivate tolerance toward others, and tolerance for their opinions?
27. Investigate your own prejudices and speculate as to what might be their origins.
28. Does the way we think have an effect on our mental health?
29. Is it possible for one to control and guide his thinking? Of what importance is this to the individual?
30. Why should one acquire a philosophical view of life? Have you an outlook on life that is satisfactory to yourself, or are you perplexed on this point?
31. What are ideals? What bearing have they on mental health?
32. Of what value is a sense of humor to the health of the mind?
33. Of what significance is work to mental health?
34. In general, of what value is it to mankind that human beings raise their level of intelligence?

35. Explain the importance of the habit of concentration in the training of the mind.
36. Differentiate between a psychoneurosis and a psychosis.
37. Explain: (a) hysteria, (b) obsession, (c) compulsion, (d) phobia, (e) neurasthenia, (f) psychopathic personality.
38. What behavior patterns characterize schizophrenia?
39. What symptoms characterize manic-depressive psychosis?
40. Discuss paranoia.
41. What is psychotherapy? Of what value is it to mentally maladjusted persons?

TOPICS FOR ORAL OR WRITTEN REPORTS

1. List as many attitudes of mind as you can and arrange them in parallel columns, one containing desirable, the other undesirable attitudes.
2. Rate yourself as fairly as possible on a scale of 10 in each of the following characteristics: (a) ambition to succeed, (b) thoroughness, (c) reliability, (d) truthfulness, (e) religious tolerance, (f) contentment, (g) loyalty, (h) cheerfulness, (i) cooperation with others, (j) observance of social conventions.
3. Discuss the health implications of the four freedoms of the Atlantic Charter, i.e., freedom of speech and expression, freedom of worship, freedom from want, and freedom from fear. Are they essential to total health? Why?
4. Investigate the influence of Clifford W. Beers on the modern treatment of the mentally ill.

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CHAPTER 15

Recreation and Rest



NEED OF RECREATION

To LIVE life fully requires a well-ordered program of work, recreation and rest. The hours spent in work represent an obligation to society; the time spent in sleep is the price man must pay for being a biologic creature; leisure hours represent time that man may spend as he pleases. The way he spends his leisure hours has an important bearing on his health, his efficiency and his character.

Leisure time is the time left of the daily twenty-four hour cycle after subtracting the hours taken up by work, sleep and eating. It is time that must be spent as it comes along for it cannot be hoarded. Leisure hours should be utilized chiefly for recreational purposes. Much time can usually be saved during the day if the individual takes a few minutes each morning to plan the day's schedule of activities, particularly the leisure-time pursuits. To acquire the art of living happily necessitates the proper utilization of one's free hours. It is inconsistent with happiness and good health to regard leisure time as time for idleness. Leisure hours that become empty hours may be a very heavy burden to the individual.

Recreation includes those activities which provide diversion from the usual tasks of the day. The word "recreation" literally means to create anew. It is through recreation that man renews his energies and his capacity to enjoy life. Proper adjustment to modern life requires the inclusion of recreation in the program of daily living. Any wholesome activity is recreational when the participant chooses to do it for the satisfaction he derives therefrom. Recreation provides release from tension and from the cares of the day. It provides an outlet for many of our emotional urges. Recreation enlarges the individual's interests and contributes to the development of his personality. The character of an individual is in part determined by the recreational activities of his youth. Certain recreational pursuits provide opportunity for the utilization and development of talents not required in the individual's daily work, and thus serve as outlets for creative ability and self-expression.

Leisure time offers great opportunities for the enrichment of living; i.e., it is a valuable asset; however, it may be a liability. Using one's leisure in search of mere excitement or thrills is unwise. Thrills may overstimulate the nervous system and exhaust the physiologic resources of the body. Recreation should bring about renewal of life, not exhaustion; a physical and mental upbuilding, not depletion. Amusements that weaken or degrade are, of course, unhygienic. Pursuing pleasure does not bring happiness. Happiness depends upon the whole rhythm of a person's life—his work, recreation, mental attitude and habits of daily living.



Fig. 37. Open air activities furnish wholesome recreation. (Courtesy of Cranbrook School.)

TYPES OF RECREATION

There are various types of recreation. In some types the individual plays a passive role; he observes the achievements of others but does not participate in the activity. In others he is a participant. Although there is need for both forms, those that require active participation have greater value. It is better for the individual to be a participator than a spectator. The greatest rewards come to the players. Participation in games and sports is of value not only because of the recreation and physical exercise afforded but also because it helps one to unfold and develop, and often reveals latent capacities. It teaches one to give and

take, to cooperate with others, observe the rules of the game, play fair and meet defeat honorably. In other words, it develops sportsmanship which is a valuable attribute as a lifelong code, in the great "game of life."



*To him who in the love of nature holds
Communion with her visible forms, she speaks
A various language; for his gayer hours
She has a voice of gladness, and a smile
And eloquence of beauty, and she glides
Into his darker musings, with a mild
And healing sympathy that steals away
Their sharpness ere he is aware.*

—WILLIAM CULLEN BRYANT.

Fig. 38. Time spent in the sanctuaries of nature encourages an appreciation of the beautiful, develops lofty ideals, healthy minds and enthusiasm for life. (Courtesy of Palisades Interstate Park Commission, N. Y.)

Because passive recreation is more readily available to most people than the active type, there is a strong tendency to choose it to the neglect of the active type. Much of the passive recreation, such as listening to the world's finest music or sitting in the grandstand and witnessing a professional baseball game, where one sees the greatest players in the sport, has great value. The mind is diverted into new channels. Everyone,

however, should be an active participant in many of his recreational outlets.

It is desirable to include various types of activities in one's recreational program. If a person limits himself to a single kind of activity he may soon lose interest in it. Suitable recreational pursuits include: (1) games and sports, such as baseball, tennis, bowling, badminton, archery, golf and swimming; (2) playing some musical instrument, singing or listening to music; (3) reading good literature or engaging in other types of literary activities, such as writing short stories; (4) drawing or painting; (5) engaging in dramatic activities; and (6) becoming an amateur naturalist.

Motion pictures and the radio have become important sources of entertainment in the modern world. Both of these agencies have great possibilities for enriching human life. They could become better media of entertainment if present standards were raised. It is to the advantage of the individual to cultivate a discriminating taste for the better types of amusements and entertainments. They are superior in the satisfaction they provide and in their effect on personality. In the field of literature there is a wide choice of reading matter that has recreational value. It is advisable to avoid the maudlin and salacious kind, the highly sensational sort, and the kind that lacks artistry.

Responding to the call of the out-of-doors and engaging in exploring nature has much recreational value. Nature affords a varied spectacle and constitutes an endless source of interest.

Among the newer recreational assets are the youth hostels, located about fifteen miles apart, that provide inexpensive overnight lodging and other accommodations for pedestrians, bicyclists or equestrians as they travel (alone or in groups) through the country. The hosteler buys and cooks his own food. Short trips of a few days or extensive trips may be taken. The hostels are under the auspices of the American Youth Hostels,¹ a nonprofit organization.

RECREATION AND JUVENILE DELINQUENCY

It is of paramount importance that right kinds of recreational facilities be available to the youth of our nation. In many communities adequate recreational facilities are lacking. Juvenile delinquency results in part from the fact that many young people do not have a suitable way of utilizing their leisure hours. It is the responsibility of every community

¹ For information regarding membership, and the location of hostels in your locality, address American Youth Hostels, Inc., Northfield, Mass.

to provide adequate recreational facilities for its people, particularly its young people. Recreation plays an important part in satisfying the mental, physical and emotional needs of individuals and in the development of healthy personalities. A community recreation program channels the natural urge to play into wholesome activities.

HOBBIES

Recreation may be experience shared with others or it may take the form of an avocation or hobby. To attain a full measure of living one should have one or more hobbies. A hobby adds enthusiasm and satisfaction to life and ensures against boredom. It can be a source of intense personal satisfaction. A person who has a hobby has something interesting to do for all the leisure hours he cares to devote to it.

Hobbies can be found in many fields of interest. Most hobbies fall into one of three categories: (1) creating hobbies, (2) collecting hobbies and (3) study hobbies. Creating hobbies include drawing, painting, sculpturing, photography and various crafts. Collecting hobbies involve the building up of collections of certain articles such as pottery, stamps, antiques, clocks or buttons. Study hobbies include reading or study in some special field of interest such as astronomy, archeology, ornithology and literature. A good hobby has possibilities for development and therefore holds promise of continuing interest. Certain hobbies provide excellent outlets for the individual's creative and exploratory ability. Since many hobbies are intermittent or seasonal, it is advisable to develop several hobbies.

NEED OF REST

Normal life moves along in rhythmic fashion with alternate periods of rest and activity. During periods of activity it does not continue at the same pace but varies its rhythm as does music. Under present-day conditions of life many people live too strenuously. Continuous activity brings about fatigue. Fatigue diminishes efficiency and lowers resistance to disease. It occurs chiefly in the muscular and nervous systems and results from the accumulation of fatigue products which interfere with the functioning of these systems. During periods of rest, fatigue products are gradually removed by the circulating blood and lymph. Rest restores normal body rhythms.

Rest does not necessarily mean cessation of activity. Change of activity often serves to rest cells or parts of the body that have been used in work. After hard mental work, for example, a walk in the open air will

rest the brain cells. Rest and recreation, therefore, may often be taken at the same time. There is truth in the old saying, "A change of work is rest." Too much rest in the form of inactivity becomes irksome and, therefore, is not healthful.

Occasional periods of cessation of activity, during the day, are of value. Lying down and relaxing mentally as well as physically for ten to fifteen minutes helps to restore mental and physical vigor. It is good practice for students to rest for short periods while they are studying. Continuous study for hours in succession may cause the mind to become "stale." It can be refreshed by short periods of rest. Overfatigue should be avoided for it causes irritability, listlessness and loss of faith in oneself.

SLEEP

Sleep is a normal condition of the body in which the activities of the nervous system are so far reduced that complete or partial unconsciousness occurs. The muscles relax and breathing becomes slower and deeper. During sleep the body recuperates its vitality.

Regular sleep in adequate amounts is an essential part of the program of living. Habitual loss of sleep decreases body efficiency. Loss of sleep for any length of time causes irritability, depression and loss of weight.

No set rule concerning the amount of sleep can be stated. The amount varies for different individuals and for the same person at different times. The amount needed depends largely on how well one sleeps, i.e., how completely one's sleep is recuperative. Some people recuperate in less time than others. The first two or three hours of sleep are usually deeper than the remaining hours, but there is no scientific evidence that they are more recuperative. Most people need about eight hours of sleep; some need more, others require less.

A well-ventilated bedroom is conducive to refreshing sleep. Other conditions for sound sleep are quietness, darkness, warmth and comfortable covers. The pillow should be only sufficiently thick to permit the head and spine to remain in a straight line when the person is lying on his side.

SLEEPLESSNESS

Sleeplessness, or insomnia, refers to the inability to obtain a sufficient amount of sleep due to difficulty in falling asleep and spending the night in sound slumber. There are many factors that may cause sleeplessness. Emotional excitement at bedtime, improper food, an insufficient amount of exercise, studying late into the night, inability to banish from the mind

the events of the day, constipation or worrying over real or prospective troubles may keep one awake. Drinking coffee at the evening meal affects some people by delaying the onset of sleep. Insomnia is more prevalent among brain workers than among those who do physical work.

Insomnia, in many cases, can be overcome by one or several of the following methods: (1) having a regular bedtime; (2) assuming a calm mental and emotional attitude upon retiring; (3) taking physical exercise at bedtime, such as a brisk walk in the open air; (4) drinking a glass of hot milk just before going to bed; (5) thoroughly relaxing the muscles of the body; (6) reading a short story before going to bed to divert the train of thought away from the daily cares; (7) taking a fifteen-minute tub bath with the water about 95° F. The temperature of the bath must be kept slightly below that of the body so that heat loss from the body will not be interfered with.

An individual troubled with insomnia should not permit himself to worry about it. Worrying about it may do more harm than the loss of sleep. Freedom from anxiety removes in large measure the harmful results of loss of sleep and produces an attitude of indifference which tends to bring about sleep.

HEALTH PRACTICES TO BE ACQUIRED

Correct adjustment to environment includes a suitable amount of recreation and rest in the daily life of the individual. The following health practices should be cultivated:

1. Carefully plan your leisure time activities.
2. Engage in enjoyable recreation each day, preferably some outdoor activity in which you can become a participator rather than a mere onlooker.
3. Cultivate a hobby and devote to it a part of your leisure time.
4. Include several short rest periods of ten to fifteen minutes in each day's program.
5. Obtain each day an adequate amount of sleep under healthful conditions.

QUESTIONS FOR CLASS DISCUSSION

1. What use should be made of one's leisure time?
2. Explain the meaning of the term "recreation."
3. Of what significance is recreation?
4. How does passive recreation compare in value with the kind that requires active participation?

5. What are suitable recreational pursuits of the passive type? The active type?
6. Discuss recreation and juvenile delinquency.
7. What are the three categories that may be used in classifying hobbies?
8. Of what particular value are hobbies?
9. Why does the body need rest? How may it be obtained?
10. Discuss sleep.
11. What are the penalties for continued neglect to obtain adequate sleep?
12. Why should sleeping rooms be well ventilated?
13. What is insomnia? How may it be remedied?
14. Summarize the health practices one should acquire in regard to the use of one's leisure time.
15. What health practices are needed for the recuperation of body energy?

TOPICS FOR ORAL OR WRITTEN REPORTS

1. Investigate the youth hostels and outline week-end or longer tours on foot, bicycle or horseback.
2. Make a survey of the field of hobbies and report on those that seem to you to be especially worthwhile.
3. Keep a record for a seven-day period of the use you make of the leisure hours you are able to snatch from a busy life. At the end of the period make a critical examination of the use you make of your leisure time. Is your daily schedule a satisfactory one? How may it be improved?
4. Investigate the recreational facilities afforded by your community.

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CHAPTER 16

Hygienic Aspects of Sex



SEX is a tremendously important aspect of human life. Upon it as a foundation rests love, courtship, marriage and family life. The sex drive is a powerful force possessing destructive as well as constructive significance. It is necessary to understand its potentialities and to direct it with intelligent understanding. As is true of other great forces (electricity and mechanical energy) possessing both constructive and destructive possibilities, sex is capable of doing harm unless it is understood and properly managed. The sex drive misused, uncontrolled and undirected is responsible for much of the wreckage of human health and happiness.

MENTAL ADJUSTMENT TO SEX

A realistic attitude toward sex helps the individual to meet in a satisfactory manner the problems of life that center about the sex impulse. To live at one's best one must learn to guide his primitive drives into channels that will meet with the requirements of the social conventions. Human happiness and well-being depend to a large degree upon proper mental adjustment to the problems of sex. Some persons become morbid about sex because they feel that the sex impulse within them is an indication of wickedness. This attitude may lead to mental distress and ill health. The sex drive is a normal attribute of human beings. Sex is an essential and thoroughly respectable part of human life. A properly adjusted person is not unduly disturbed by his sexual nature and the problems that grow out of it.

CONTROLLING THE SEX IMPULSE

A person who has acquired the art of conducting his life so that it will yield a maximum of well-being and happiness understands his impulses and has goals which he seeks to attain. He also has the kind of mental attitude that enables him to forego immediate gratification of certain desires for future enjoyment and satisfaction.

In modern society a person matures sexually long before he is economically in a position to get married and establish a home. For his own best interests it is necessary for him to adjust himself to this situation. Some persons never marry because they choose to take up a life of celibacy in the conviction that such a life is a desirable one for them. A continent person can lead a normal, healthful life since continence is not harmful to the individual. Recognizing the sex drive and understanding it enables such persons to make entirely satisfactory adjustments to life. Individuals who lead a life of abstinence not out of choice but due to circumstances which they cannot alter may fail to take a satisfactory attitude toward their situation and experience pronounced frustration.

Control that is self-motivated is much more effective and satisfactory than control instituted by compulsion. A person who conforms to certain restrictions on his behavior because he feels he is forced to do so may become frustrated and otherwise mentally disturbed. Compliance due to compulsion is at best a negative response. Self-discipline that springs from a correct perspective and understanding of the situation has a constructive rather than destructive effect on personality. The problem of adjusting to sex is a highly individual matter which each individual must solve for himself on the basis of a correct understanding of his particular situation.

Sublimation. The rational way to handle a primitive urge, when it is not expedient to satisfy it, is to make it serve other ends by directing its psychic energy into channels that will further the best interests of the individual and society. Changing the outlet of human energy from a primitive to a serviceable or symbolic goal is known as sublimation. The sex urge may be sublimated by wholesome activities that furnish recreation for the body and mind. Whole-hearted interest in the affairs of life, activities of various kinds such as athletic pursuits, hobbies, creative efforts in the arts (literature, music, painting and drama) for those who possess talents in these fields, afford rational outlets for the emotional stimulus of a primitive urge.

To adjust himself to life in a satisfactory manner, civilized man must develop sublimated interests not only in regard to the sex drive but also in connection with other primitive urges which require direction into channels other than their natural outlets. Making one's self of use to the world is sound psychologically in principle, and serves as a valuable sublimated outlet for the psychic energy created by native impulses that need to be re-directed. Through sublimation, individuals frequently make great contributions to society.

AUTOEROTICISM

Sexual functioning brought about through self-stimulation of the genital organs is called *autoeroticism* or *masturbation*. The sex organs are stimulated until the sensations reach the climax known as orgasm. This phenomenon usually occurs first at puberty and may continue for a number of years after which the practice usually ceases. In the case of some individuals it may continue into adulthood. Girls resort to it less frequently than boys. The practice is looked upon by psychologists as being normal, in that it belongs to a phase of development between childhood and adulthood. No physical harm ordinarily results from it, but mental harm, due to intense feelings of guilt or fear, may result if the individual has been reproached or humiliated in regard to the practice or has been bludgeoned into believing that dire results (feeble-mindedness, insanity and sterility) will surely follow the practice. Such threats, which may convert childhood into a nightmare, are out of line with scientific facts. Since they focus attention on the practice, they are usually ineffective in stopping it, but torment the individual with fear and feelings of wickedness and depravity, which may culminate in undesirable personality traits. Although the adolescent should be informed about the practice he should not be misinformed. Instead of reproaching, threatening or punishing the individual he should be helped to find a satisfying pattern of life. His life should be filled with enough activities such as participating in community affairs, engaging in sports or pursuing a hobby, to keep his attention focused upon other interests than himself. If the practice continues over a long period of time it may cause the individual to become emotionally bound to himself. It narrows his emotional outlets, encourages aloofness and handicaps him in developing satisfying friendships. In the case of some individuals masturbation may be a compensation for unhappiness. The help of a psychiatrist is sometimes advisable.

HOMOSEXUALITY

Homosexuality is a condition in which persons are attracted chiefly to others of the same sex. Young children are homosexual in the sense that they are interested in, and associate chiefly with, persons of their own sex; boys play with boys and girls play with girls. As they mature they progress from this stage to that of being attracted to persons of the opposite sex, that is, they become heterosexual in their interests. Some fail to make this transition and continue their preference for members of

their own sex to the exclusion of interest in the opposite sex. This may serve as an obstacle to marriage or lead to frustration if a marriage is consummated.

In some individuals, homosexuality takes a perverted course. The individual may become strongly attached emotionally to and seek sexual gratification with someone of his own sex. This is regarded as a pathological arrest in psychosexual development.

PETTING

Indulging in physical intimacies such as so-called petting or necking serves as a powerful stimulus to the sex impulse. Overstimulation handicaps the individual in the use of good judgment. It should be recognized that petting is a natural approach to mating and that it may progress from "light" to "heavy" petting which in a large percentage of cases culminates in sexual intercourse. The average young person is ill-equipped to meet with the conflicts, uncertainties and unpleasant circumstances which may follow in its wake. Experts agree that the gains do not equal the cost.

Petting on the part of engaged persons, especially of the "heavy" sort, tends to overvalue the physical responses in the relationship between the sexes at the expense of the mental and emotional reactions. This may affect the attitude of the individual toward his mate after marriage and become an obstacle toward proper adjustment to married life.

PRINCIPLES OF CONDUCT

A human being is a member of a social order; he cannot be construed as a detached entity. Belonging to a group involves the responsibility of being loyal to it and observing its rules of conduct, its standards of right and wrong, which were designed to meet the practical needs of human society. If the individual assumes this responsibility he helps to strengthen the society of which he is a part. It is inadvisable that the pattern of sex behavior run counter to the social code. A person who takes a realistic attitude toward sex understands its potentialities and the need for social regulation.

By the time a well-adjusted person attains adulthood he has formulated standards of conduct and a philosophical view of life which help him in solving his problems and in the building of his character. Good morals and manners are essential in all departments of life. The proper observance of the rules marks the individual and sets him apart from those who have failed to develop the refinements so essential to good living. It is

what a person thinks and does that makes him what he is; it is his character that fixes his place in society.

Observance of the rules maintains self-respect, promotes happiness and opens the doors to opportunities that otherwise would remain closed. Usually a person who flouts the tenets of society pays a very high price for what he believes he is getting in return. The wounds of faulty adjustment to sex have permeated deep into our population.

CHOOSING A MATE

The selection and winning of a suitable mate require the use of good judgment so that the choice will result in a partner whose interests, enthusiasms, ideals and attitude toward life are consistent with one's own. The chosen one should rate well in regard to state of health, emotional maturity, level of ability and companionability. A prospective husband should give promise of being, or being able to become, a dependable provider of the necessities of life and a prospective wife should possess the necessary talents to become a good home-maker.

Similarity of interests is of particular importance. It is usually advisable to choose a partner with a background similar to one's own. Marriage between persons of different religious, economic, cultural or social backgrounds involves considerable risk of failure. It is important also that the individuals be compatible in regard to temperament.

To make a good choice it is helpful to have a wide acquaintanceship among the opposite sex. Because many persons have rather limited opportunities in choosing a mate, many marriages occur between incompatible persons. Persons who have been reared in homes in which the family life was a happy one usually make better marriage partners than those brought up in homes that were continuously torn by strife or were broken by divorce.

It should be remembered that the excitement and ecstasy of being in love may make the two persons concerned appear quite differently to one another than they actually are. If they meet frequently under a variety of circumstances they will be in a better position to arrive at a correct evaluation of one another. The engagement period should be of sufficient duration to allow the persons to become well acquainted with each other and with their families and also to give due consideration to all of the factors that will have a bearing on the success of their marriage. Studies have revealed that hastily contracted marriages are not so successful as those undertaken after a reasonable period of deliberation.

Marriage does not create new personalities from old ones. The person

chosen as a mate should be accepted as he is without reservations. It is unwise to attempt to educate or change the partner into a more suitable type of person. Too many persons entertain the naive notion that this can be readily accomplished. The personality of a person of marriageable age is sufficiently well set to resist any but minor changes. Persistent attempts to improve the spouse will spell disaster and jeopardize any chances of success the marriage might have had. It is usually only by our own conduct that we can influence those with whom we live.

LIVING TOGETHER HARMONIOUSLY

All human relationships are fraught with problems which require solution. Problems difficult of solution are more likely to arise in marriage than in other human relationships. Marriage is a cooperative endeavor that requires much more than the ecstasy of love to make it successful. A distressingly large number of couples fail in making a success of the business of establishing a home. Most of these failures are avoidable. Problems that commonly arise deal with such matters as personal habits, managing the budget, relatives, social activities and sex adjustments. Most of the difficulties grow out of the way the individuals react to their problems. Persons who did not acquire before marriage the technic of facing problems and attacking them in a realistic manner will in all likelihood fail in solving the problems that grow out of matrimony.

Insignificant situations often develop into serious disagreements because both persons lack a sense of proportion which would enable them to assign trivial matters to their true position of relative unimportance. Whenever a problem arises they respond in their customary behavior pattern and if there is a difference in points of view they fight about it in the mistaken belief that something can be gained by fighting. They are less interested in solving their problem than in gaining their point. They fail to cooperate and compromise because they never have acquired the technic of doing so. Their marital blunders frequently terminate in divorce.

Some cities now have marriage clinics manned by skilled counselors who are in a position to give advice to and assist married persons in the solution of their difficulties.

THE FAMILY

The marriage relationship when adequately fulfilled results in a new family. Since the life of civilized human beings is centered around the family, the home and the family are of paramount importance to the

children as well as to the parents. Emotional maturity is needed on the part of both parents to meet adequately the challenge of rearing children. How children adjust themselves to life depends chiefly upon the kind of family in which they are reared. It is in the home that the foundation is laid for a desirable or undesirable adjustment to life. Desirable human relation adjustments require a happy, emotionally stable home life to give the child a feeling of security and a sense of being wanted and accepted. It is essential also for the child to feel that the parents care for each other and get along well together. A family that is stable, contented and well integrated has attained a high level of social development.

Frequent quarreling, bickering and violent disagreements among the parents may cause the children to develop marked feelings of insecurity because of fear that the parents are going to separate. The anxiety may become generalized so that they look with fear upon all aspects of the future. Unpleasant home life and improper training are the chief causes of juvenile delinquency.

Conflicts between parents frequently lead to divorce. Divorce creates great difficulties for children, especially those of school age. It causes them to become disturbed in their loyalties and deprives them of the stability that only a complete family circle can provide. There is cause for society to feel disturbed over the divorce situation since the rate has been increasing rapidly in recent years. In 1940 one marriage out of six in the United States ended in divorce. At present it is almost one in three. It has been predicted that in another decade, if the increase continues at the present rate, one marriage out of every two may end in divorce.

ANATOMY AND MECHANISM OF REPRODUCTION

The reproductive or germ cells, also known as *gametes*, are produced in organs called *gonads*. Female gonads are known as *ovaries*, while male gonads are termed *testes* (singular, *testis*). Most of the other parts of the male and female reproductive systems are merely special devices for bringing about the union of male and female germ cells.

Male Reproductive System. The male reproductive system contains a pair of ovoid testes, enclosed in a skin-covered sac of loose skin, the scrotum, suspended beneath the pelvis. Each testis contains a large number of fine convoluted tubules (seminiferous tubules) in which the male gametes, *spermatozoa* (singular, *spermatozoon*) or *sperm cells*, are formed from cells lining the walls of the tubules. Spermatozoa are exceedingly small, motile, whiplike cells. From the testis the spermatozoa

are conveyed by means of small tubes (*vasa efferentia*) to a duct which is several feet long but convoluted to such an extent that it is compressed into a very small space. This tube is known as the *epididymis* and is attached to the rear of the testis. The tube continues as the *spermatic duct* (*vas deferens*). The two spermatic ducts, one from each testis, ascend into the abdomen to the underside of the bladder. Before reaching the *urethra*, the tube that drains the urinary bladder, a small tube from a sac-like *seminal vesicle* opens into each one. The combined tubes from the

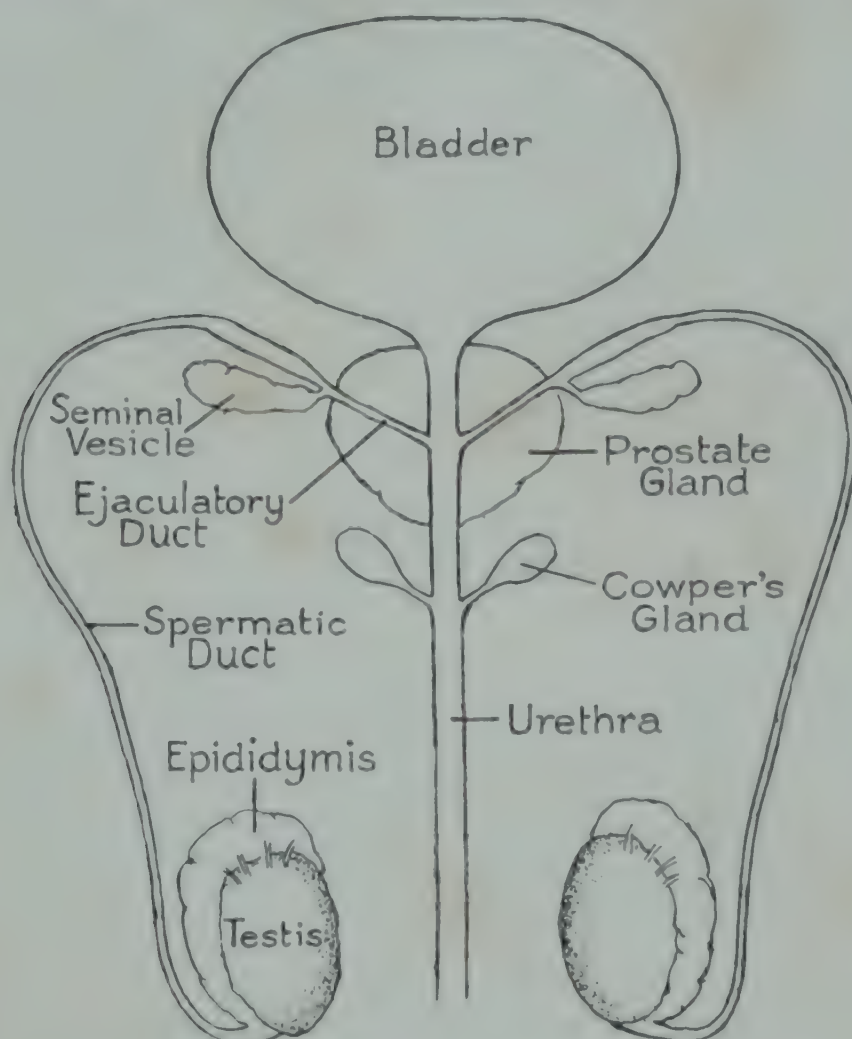


Fig. 39. A diagram of the male reproductive system.

seminal vesicle and spermatic duct form the *ejaculatory duct*, which enters the urethra on either side. The two ejaculatory ducts and that portion of the urethra immediately under the bladder are surrounded by the *prostate gland*, which is about the size of a walnut. This gland produces a secretion which enters the urethra. Below the prostate gland, a pair of small glands, known as *Cowper's glands*, open into the urethra through two small ducts. The urethra runs through the center of the male muscular organ of copulation, the penis, and serves the purpose of conveying to the outside not only urine but also *semen*, the seminal discharge containing spermatozoa. Semen contains not only spermatozoa but is made

THE VENEREAL DISEASES

There are five diseases that are primarily transmitted by sexual intercourse. The two most common ones are gonorrhea and syphilis; the others are chancroid, lymphogranuloma venereum and granuloma inguinale. Because of their high prevalence and also because of the large amount of suffering and disability that they have caused, the venereal diseases have had far-reaching effects upon the human race.

Individuals who indulge in promiscuous sexual intercourse usually

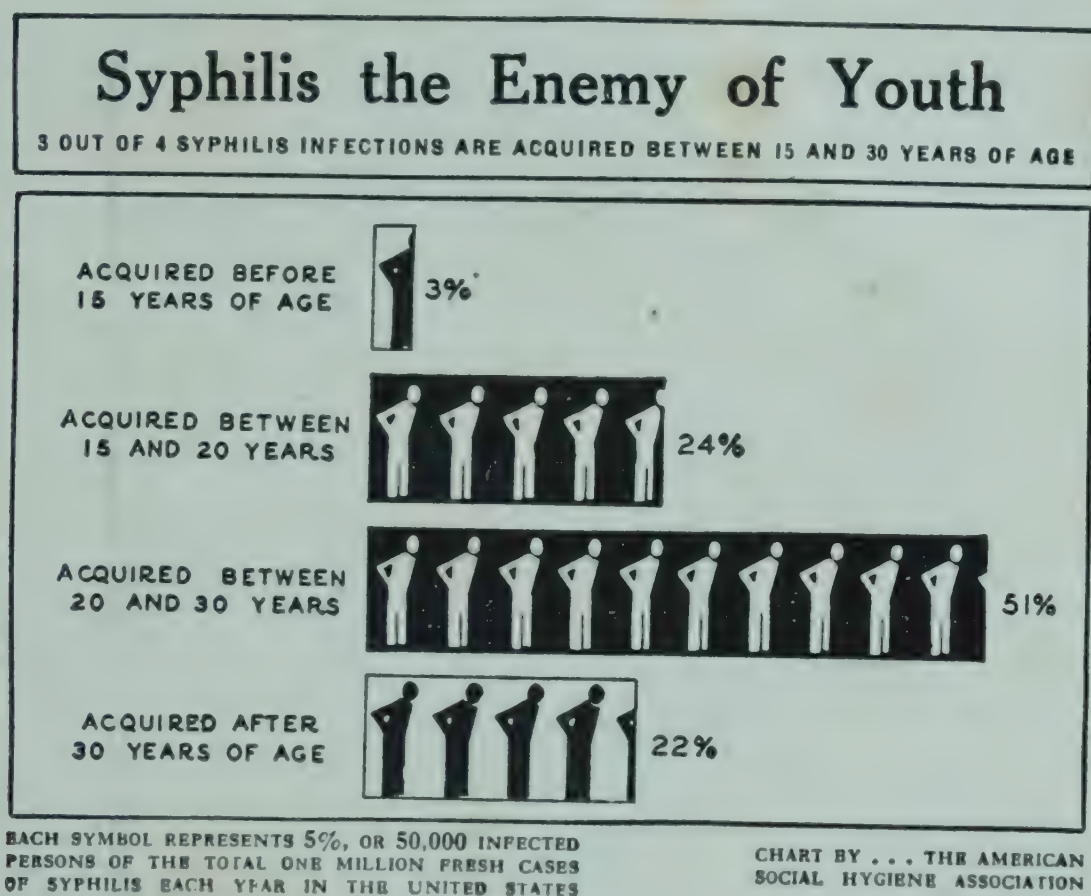


Fig. 41. Age incidence of syphilis. (Courtesy American Social Hygiene Assoc.)

acquire gonorrhea, sooner or later, and are in great danger of contracting syphilis also. Estimates indicate that 500,000 new cases of syphilis appear in the United States annually and more than 1,000,000 new cases of gonorrhea are treated by physicians each year.

GONORRHEA

Gonorrhea is caused by a spherical bacterium which bears the scientific name *Neisseria gonorrhoeae*, but is commonly known as the gonococcus. The disease is transmitted usually by direct sexual contact. Transmission may occur, however, by means of contaminated objects, but the time between contamination and transmission must be very short since the organism survives only a brief period outside of the body. Under certain conditions transmission may occur through the agency of toilet

seats and toilet accessories. The use of a recently contaminated towel may convey the organisms to the eyes.

Gonorrhea is an infection of the genitourinary tract. The infection starts in the anterior portion of the urethra in the male and in either the urethra or vagina in the female. It has a tendency to spread along contiguous mucous surfaces. The infection is accompanied by a discharge of pus.

In the male it may extend to the posterior portion of the urethra, reaching Cowper's glands, the prostate gland and the urinary bladder. It

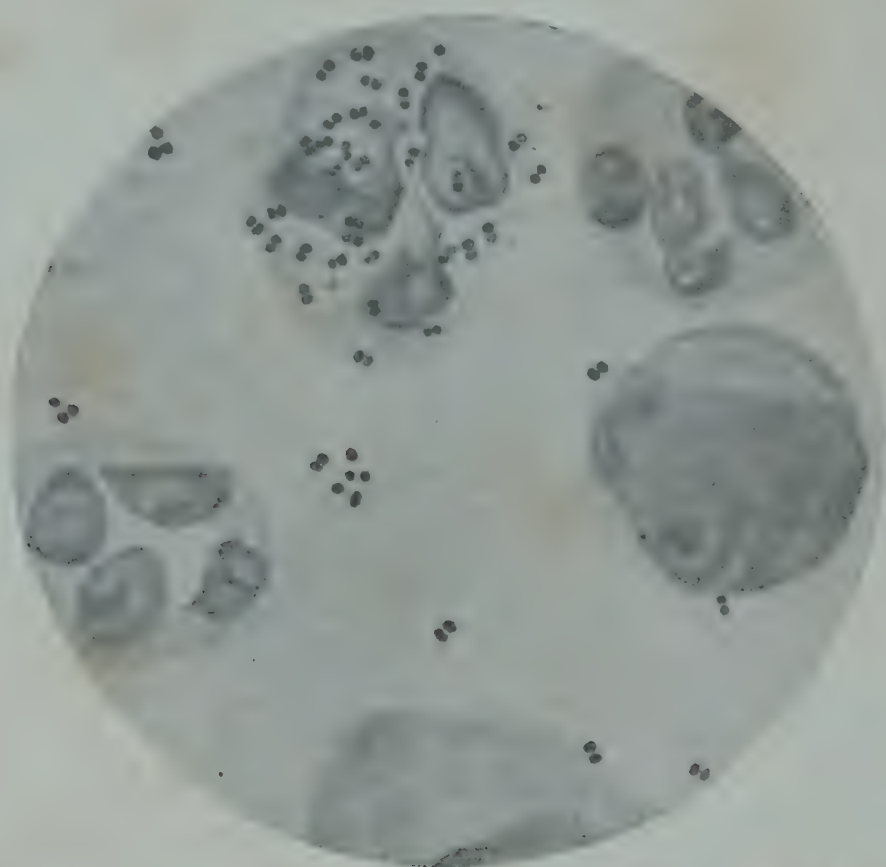


Fig. 42. Gonococcus from urethral pus. (Ford, Textbook of Bacteriology.)

may reach the seminal vesicles and extend through the vas deferens to the epididymis. If the epididymis of both testes becomes infected sterility usually results due to the closure of the tubules.

In the female, gonorrhea is not usually characterized by such acute symptoms as in the male, but the tendency of the disease to spread to adjacent parts and cause serious complications is perhaps greater. The urethra usually becomes involved. The organisms enter the vagina and reach the cervix of the uterus which is the most common seat of infection. From the cervix the organisms may enter the uterus and reach the oviducts, usually both of them. The wall of the infected oviduct becomes swollen and frequently the end near the uterus becomes closed by the inflammation, converting the lumen of the tube into a closed cavity which becomes painful, enlarged and filled with pus. The oviduct may become permanently occluded. If both oviducts are thus affected sterility

results. The gonococcus is an important cause of sterility in both males and females. From the oviducts the germs may enter the ovary and infect a ruptured graafian follicle, producing an abscess. The membrane lining the abdominal cavity, the peritoneum, may also become infected, giving rise to a local or general peritonitis.

In both male and female the gonococci may invade the blood stream and localize in the joints, causing arthritis, most commonly in the knees, wrists, elbows and ankles. Less frequently the organisms may localize in the lining of the heart (endocardium), causing endocarditis, or in the membranes (meninges) covering the brain and spinal cord, giving rise to meningitis.

Infection of the conjunctiva, the membrane which lines the eyelids and covers the eyeballs, may result from the use of recently contaminated towels or from contaminated hands. This infection, known as *gonorrheal ophthalmia*, usually results in blindness unless prompt treatment is instituted. A gonococcal infection of the eyes of the newborn is known as *ophthalmia neonatorum*. The infection is acquired from the mother as the head of the child passes through the infected maternal genital tract. The instillation of a few drops of a suitable antiseptic solution into the eyes at birth usually destroys the gonococci before they can become established in the tissues of the eyes. In many states this is required by law whether or not the mother is suspected of having gonorrhea. Silver nitrate is usually employed for this purpose.

Vulvovaginitis is a gonococcal infection of female children usually conveyed by contaminated towels, articles of clothing or toilet seats. The infection tends to remain localized. The vagina of a young child is more susceptible to infection by the gonococcus than that of an adult. The disease is very difficult to cure.

Although it is difficult to obtain exact data in regard to its incidence, it is known that gonorrhea ranks high in prevalence, probably being exceeded only by measles. It has been estimated that a million fresh infections occur annually in the United States. Promiscuous sexual intercourse is the chief factor in the spread of the disease. If this could be halted the incidence would sharply decline. Prompt treatment of gonorrhea shortens the course of the disease and usually prevents complications from developing. Penicillin has been found to be effective.

SYPHILIS

Syphilis is a chronic infectious disease caused by a slender corkscrew shaped organism known as *Treponema pallidum*. It is a member of a group of bacteria called *spirochetes*. Promiscuous sexual intercourse is

the chief factor in the spread of the disease but transmission may occur also by kissing a syphilitic individual. In rare instances it may be transmitted through the medium of contaminated towels, drinking cups or other utensils if used shortly after their use by a syphilitic. It may be transmitted also from a syphilitic woman to her unborn child. Syphilis acquired in this manner is known as *congenital syphilis*.

Syphilis is characterized by an initial lesion known as a *chancre*, occurring at the point of entrance of the spirochetes, followed by symp-

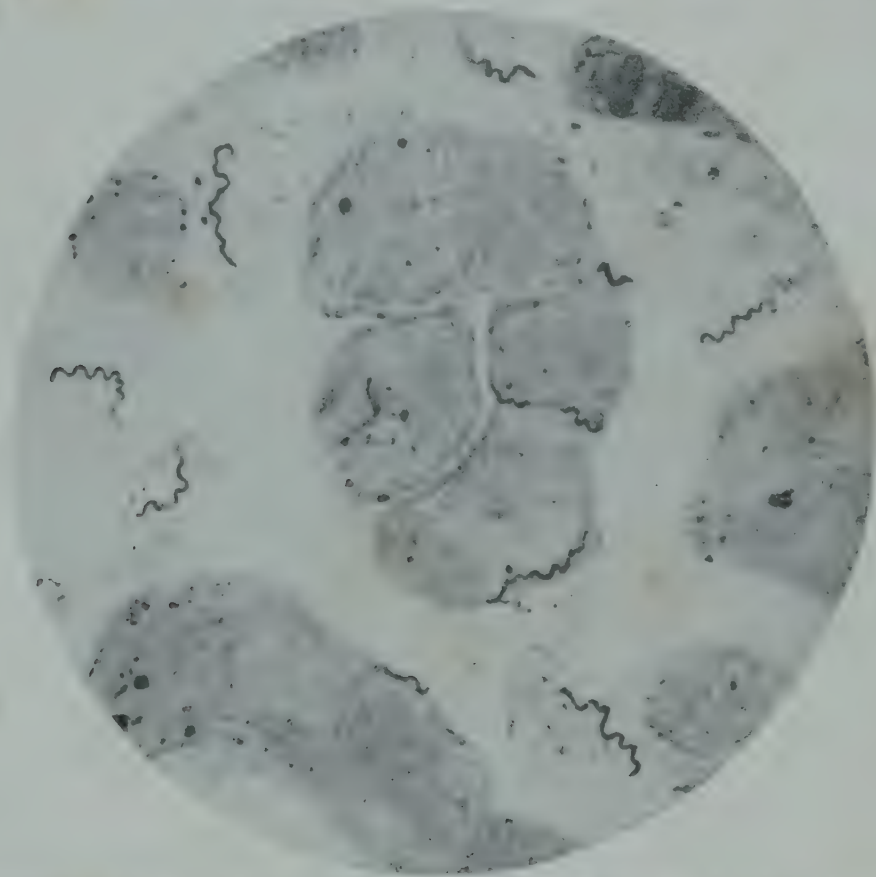


Fig. 43. *Treponema pallidum* from liver of syphilitic fetus. (Ford, Textbook of Bacteriology.)

toms in various parts of the body. The course of the disease has been divided into three stages, *primary*, *secondary* and *tertiary*.

Primary Stage. After an incubation period of two to four weeks the disease manifests itself by the appearance of the initial lesion, the chancre, which is always located at the point where the spirochetes gained entrance to the tissues of the body. The chancre is a small vesicle which soon ruptures, forming an ulcer which enlarges, becoming hard and flat. The most frequent site of the chancre is on the mucous surface of the genitalia. It may go undetected in the female because of its location within the folds of the mucous membrane or on the cervix of the uterus. If the disease was transmitted by the act of kissing, the chancre will appear on the lips, within the mouth or on the tonsils. The chancre is highly infectious as the exudate from its surface teems with the syphilitic spirochetes.

The primary stage is attended by little or no discomfort. This is unfortunate since it operates against early diagnosis and the early application of proper treatment to prevent the spread of the disease. After about six weeks the chancre disappears.

Secondary Stage. The secondary stage manifests itself from six to twelve weeks after the appearance of the chancre. The spirochetes are now no longer localized but have entered the blood stream and have accomplished a general invasion of the body. A characteristic of this stage is the multiplicity of its symptoms and the great variation in the intensity of the symptoms. The symptoms vary in different patients. Not any of the symptoms are distinctive. The patient may experience headaches, sore throat, pains in the joints, enlargement of the lymph nodes, and eye lesions may occur. Usually a rash appears on the face, neck, trunk and limbs. The rash may be so faint as to be scarcely discernible or it may be very pronounced. Mucous patches in the mouth, throat and genital organs are characteristic of this stage. The spirochetes are abundant in these lesions. The infection takes a malignant course in some individuals and is exceedingly mild in others. The duration of the secondary stage is variable, from a few months to several years.

Tertiary Stage. After the symptoms of the secondary stage have subsided the disease passes into a latent period, in which no visible signs of the disease are present before entering the tertiary stage. The period of latency may continue for many years, the average being from six to eight years. The period of latency is terminated by the appearance of the symptoms of tertiary or late syphilis. This stage is characterized by the appearance of chronic, progressive, ulcerative and very destructive lesions. Degenerative lesions of the heart and blood vessels (cardio-vascular syphilis) are common. The wall of the aorta, the large artery by which the blood from the left ventricle leaves the heart, is very frequently involved. The wall of this artery may become weakened to the extent that bulges appear. If it should break, death ensues immediately. The brain may be attacked by the spirochetes, giving rise to *paresis* which involves progressive loss of mental ability and loss of motor control of the muscles, thus resulting in what is known as "general paralysis of the insane." In some patients the lower portion of spinal cord is attacked, bringing about the condition known as *locomotor ataxia* or *tabes dorsalis* which is characterized by a peculiar gait and inability to control the lower limbs in a normal manner.

Congenital Syphilis. Syphilis may be transmitted to the fetus (unborn child) from the syphilitic mother by way of her blood stream

during the period of gestation. Syphilis acquired in this manner is called congenital syphilis. A fetus so affected may be born dead, born during the secondary stage or during the latent period following the secondary stage. The manifestations frequently seen in early congenital syphilis are eruptions on the face, palms and soles, snuffles, tenderness and enlargements at the ends of the bones of the limbs and the beginning of "saddle nose" due to the involvement of the nasal septum. Later the saddle nose becomes more pronounced, the face becomes "dish-shaped" and the teeth of the second dentition appear with characteristic notches (Hutchinson's teeth). Bone lesions may develop and juvenile paresis and tabes dorsalis are frequently encountered. It has been estimated that in the United States 60,000 children are born every year with the handicap of congenital syphilis.

Treatment. Penicillin has now taken a prominent place along with chemicals in the treatment of syphilis. Adequate treatment quickly renders syphilis noninfectious and cures most cases that have not reached the tertiary stage. In the tertiary stage treatment is less effective than in earlier stages. It has been found that artificially induced fever is beneficial in cases in which the central nervous system is involved (neurosyphilis). The fever is produced either by inoculating the patient with malaria germs or by placing him in a special apparatus known as a fever cabinet. Drug therapy is used in conjunction with the fever treatment.

VENEREAL DISEASE CONTROL

Because the venereal diseases have permeated deep into our population and have perpetrated untold damage to society, they constitute a public health problem of major importance. The control of these diseases is complicated because of their association with prostitution and sexual promiscuity. The community as a whole must become active in combating the menace of venereal disease. A nation-wide effort to eradicate syphilis and gonorrhea through a program of effective control has been put into effect by the United States Public Health Service. Vigorous measures to deal with the venereal disease problem have been instituted. Measures of importance are: (1) educating the public to the dangers of promiscuity, (2) encouraging people to maintain high standards of sex morals, (3) eliminating commercial prostitution, (4) prompt treatment of all cases, (5) placing under supervision all persons infected with venereal disease and those with whom the infected persons have had sexual contact and (6) providing a wholesome environment with adequate recreational facilities for all members of the community.

Premarital Examination. A majority of our states now have laws which require that applicants for marriage licenses submit to an examination by a physician for the presence of venereal disease. A certificate of freedom from venereal disease is a prerequisite for the issuance of a marriage license.

Prenatal Examination. In the attempt to stamp out congenital syphilis a large number of our states now require that physicians give blood tests for syphilis to all expectant mothers who consult them. Many women (as well as men) have syphilis without knowing that they have it. Detection of syphilis early in pregnancy followed by modern treatment usually assures the birth of a child free from syphilis. The treatment should start before the fifth month of pregnancy. A child born of an untreated syphilitic woman has only one chance in ten of escaping congenital syphilis.

These prenatal tests for syphilis are only partially effective in preventing congenital syphilis because many expectant mothers do not go to their doctors early enough to receive the preventive treatment should they require it.

HEALTH PRACTICES TO BE ACQUIRED

A satisfactory adjustment to the problems of sex requires the inclusion of the following practices:

1. Acquire a realistic attitude toward sex so that you will fully understand its potentialities.
2. Accept the fact that sex is a respectable part of human life, but that, like many other impulses, the sex drive must be directed by intelligent understanding.
3. Acquire the habit of using wholesome activities as outlets for the emotional stimulus of the sex urge. In other words, sublimate sex desire.
4. Assume the responsibility of being loyal to and observing the rules of the society of which you are a constituent part.
5. Avoid situations that overstimulate the sex urge.
6. Make every attempt to use good judgment in choosing a mate.
7. After marriage, establish a happy, emotionally stable home life to give your children a feeling of security and a sense of being wanted.

QUESTIONS FOR CLASS DISCUSSION

1. Discuss the statement that sex is a powerful force possessing destructive as well as constructive significance.
2. Explain the significance of the statement that a person who wishes to obtain a maximum of well-being and happiness must take a realistic attitude toward sex

3. Why should the individual acquire a self-motivated control over his sex drive? What advantage does this have over conformance to the social code due to a feeling of compulsion?
4. What is meant by sublimation in connection with a human drive?
5. How should the problem of autoeroticism or masturbation be handled?
6. Explain the terms "homosexual" and "heterosexual."
7. What attitude should the unmarried individual take toward the practice of "petting?"
8. Which points require consideration in choosing a marriage partner?
9. Why do so many people fail in making their marriage a successful relationship?
10. Discuss the significance of a happy, emotionally stable family life in regard to the individuals concerned and society in general.
11. Explain the reproductive system of the male and female.
12. Identify and locate: (1) gonad, (2) ovary, (3) testis, (4) gamete, (5) ovum, (6) spermatozoon, (7) epididymis, (8) spermatic duct, (9) urethra, (10) seminal vesicle, (11) prostate gland, (12) oviduct, (13) uterus.
13. What is a graafian follicle?
14. Define: (1) testosterone, (2) estrogen, (3) progesterone, (4) corpus luteum.
15. What is meant by "fertilization?"
16. Name the causative organism of gonorrhea.
17. What are the important manifestations of gonorrhea in the male? In the female?
18. Explain: (1) gonorrheal ophthalmia, (2) ophthalmia neonatorum, (3) vulvovaginitis.
19. How widespread is gonorrhea?
20. Name the causative organism of syphilis.
21. Name the three stages of syphilis and briefly discuss the symptoms that characterize each stage.
22. What is congenital syphilis?
23. What is the social significance of the venereal diseases?
24. Can a person have syphilis without knowing it?
25. Explain the importance of premarital and prenatal medical examinations in relation to venereal disease control.
26. Summarize the health practices needed for proper adjustment to sex.

TOPICS FOR ORAL OR WRITTEN REPORTS

1. Inquire into the relationship of the drinking of alcoholic beverages to sex delinquencies.
2. Obtain data concerning the divorce rate in your community.
3. Outline a procedure which in your opinion would subjugate the venereal diseases.

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CHAPTER 17

Health Fads, Fancies and Follies



MANKIND has not yet attained freedom from ignorance and superstition. Although we are living in a scientific age, many of our people do not have a scientific attitude of mind; they still embrace with persistency and obstinacy the whims, caprices, prejudices and superstitions of our ancestors. They lack understanding of the laws that govern their lives and consequently are incapable of logical thinking in regard to matters pertaining to health. Instead of accepting the guidance of science they readily become victims of superstition, fads and fancies, are easily misled by glib radio announcers and alluring advertisements, and permit themselves to be exploited by clever quacks, members of healing cults and shrewd concocters of so-called "patent" medicines.

The minds of many of our people have been conditioned to believe that magic plays a role in human lives, that evil can be repelled with charms and that certain objects (amulets) have power to protect one from danger, especially disease. Their minds have not been trained to do the kind of thinking and carry out the practices necessary for satisfactory living in the modern world. Their point of view is difficult to change since human beings do not break away easily from the effects of early conditioning. The only hope of improving this situation lies in education which will develop a scientific attitude of mind and an understanding of nature's laws. The correct use of accurate information is indispensable, for man cannot build a wholesome way of life on delusions, illusions or false assumptions.

THE SCIENTIFIC METHOD

The achievements of science read like a story from the Arabian Nights, yet magic plays no part in the mental processes of scientists. Science is a search for the unknown; its purpose is to determine the truth in regard to the nature of the world we live in and the forces that operate in it and influence our lives. Facts, not opinions or beliefs, determine truth. The

natural curiosity of man has led him to devise a method for exacting the truth from nature; this method is known as the scientific method. It is not limited to the field of science but can be used in all types of investigations and in the affairs of daily life. The scientific method consists of (1) systematic observation of phenomena, (2) controlled experiment and (3) drawing conclusions justified by the facts.

The findings of science are verifiable by anyone who reviews the phenomena or repeats the experiment. Huxley defined science as "trained and organized common sense." The scientific method produces results; it has transformed the world by giving man the telegraph, telephone, radio, automobile, antitoxins, vaccines, valuable medicines, x-ray, and a vast amount of knowledge which has added to the fullness and richness of man's life on the earth.

HUMAN GULLIBILITY

Despite the fact that we are living in an age of science, a large part of our population is addicted to superstition, untrained in sound reasoning, unable to differentiate between truth and pretense, and ever ready to accept opinions as though they were facts. Modern man is a very gullible creature. His reactions to situations are determined by his emotions. Many persons are unable to differentiate between those who honestly interpret scientific facts and those who misrepresent them for some ulterior motive.

Human gullibility exhibits itself in many forms. It is well illustrated by the branch of superstition known as astrology¹ which holds that the celestial bodies have a calculable influence on the life of each human being. Although it has no scientific basis, there are in the United States an estimated number of 25,000 professional astrologers to whom the public pays the estimated sum of \$20,000,000 annually for their horoscopes, prognostications and personal consultations.

People untrained in sound reasoning are continuously arriving at wrong conclusions even in matters of extreme personal importance. False reasoning occurs commonly in connection with matters pertaining to health. This can be illustrated in the case of a person suffering an attack of illness and taking a patent medicine supposed to be a remedy for the ailment from which he believes he is suffering. After a week has elapsed he recovers and attributes his recovery to the medicine. He reasons that because he recovered after taking this medicine his recovery was due to

¹ Astrology should not be confused with astronomy, which is the science that treats of the positions, magnitudes and motions of the celestial bodies.

the medicine. He experimented with a patent medicine but his experiment was uncontrolled. It does not occur to him that he might have recovered in the same period of time without taking the medicine, or that recovery might have been impeded rather than assisted by the medicine.

The natural tendency of the body in sickness is to get well. Human beings suffer from many ailments which are of but short duration and from which they recover through their own natural recuperative power. Even in the more serious ailments recovery frequently occurs without medical aid. From authentic sources we learn that about 80 to 90 per cent of the ills of mankind disappear without medical treatment through the healing power of nature (*vis medicatrix naturae*).

Because one event may follow another, the two events are not necessarily causally related. Kant, the philosopher, pointed out that the type of reasoning in which a mere sequence of events is confused with cause and effect is the greatest cause of human error. He described it by the Latin phrase "*post hoc, ergo propter hoc*," which means, "after it; therefore because of it." *Post hoc* reasoning enables patent medicine vendors to obtain thousands of testimonials for nostrums which scientific medicine knows to be worthless. A patent medicine testimonial is a description of an uncontrolled experiment and as scientific evidence it is entirely without value.

COMMERCIAL ADVERTISING

Commercial advertising, utilizing newspapers, magazines, billboards, radio and television, has created many misconceptions in the minds of people concerning matters of health. Health advice thus offered is designed to promote the sale of certain commodities and not to improve the public health. Articles having a bearing on health commonly advertised to the public include pain-relieving preparations, antacids, cold and cough medicines, tonics, laxatives, sleep-producing drugs, obesity cures, vitamin capsules, dentifrices, and remedies for rheumatism, indigestion, asthma, hay fever, epilepsy, fallen arches, bleeding gums, and so on.

Modern advertising is based on the psychological principle of arousing desire rather than on the principle of appeal to reason. Statements in the advertisements often are truthful only in part or entirely untruthful. A clever juggling of words is often resorted to in order to create a desired impression and yet avoid running afoul of the law. Much use is made of partial truths and misleading inferences. Playing upon some fear, as well as the desire for health, is a favorite means of exploiting the sick and the

gullible. Misinformation is always a menace and when it pertains to matters of physical and mental well-being it is a direct menace to the health of the people. A higher level of intelligence on the part of the public and less inclination to believe in miracles, would make unprofitable the deception and dishonesty characteristic of much of the advertising of commodities that are supposedly produced to further the health of the people.

MISUSE OF DRUGS

The medicines used by physicians in treating their patients have been prepared according to definite standards in regard to strength, potency



Fig. 44. Self-prescribing has been injurious to a great army of people. (Courtesy of American Druggist.)

and purity. The standards are established by representatives of the medical and pharmaceutical professions. Most of these preparations are listed in two authoritative books, the United States Pharmacopoeia and the National Formulary. Both of these books have been made legal standards by Federal law and the preparations they list are called official preparations.

New and Nonofficial Remedies is a book published annually by the American Medical Association. It lists and describes new drugs which have not yet become official, but which on the basis of animal tests and clinical experience have received the approval of the Council on Pharmacy and Chemistry of the American Medical Association.

Drugs are not mysterious charms, but are chemical agents which produce their effects by reacting chemically with body constituents. There are few drugs that possess any direct curative power. Most medicines are used not to cure disease but to alleviate pain or other undesirable symptoms. A few are used to prevent disease. Most medicines are dangerous if unwisely employed. In addition to the standardized official medicines, there are preparations on the market, the ingredients of which are kept secret. Although not patented they are commonly called "patent medicines," but the term *nostrum* is a more appropriate one. Since these medicines are not standardized, the proprietor may change the formula at any time. The maker of a nostrum coins a name for it which he then registers as a trademark. He thus secures exclusive rights to the use of the name.

Self-medication. Nostrums are made to be sold directly to the public for purposes of self-medication. Their sale is dependent upon heavy and continuous advertising, which usually contains misleading statements concerning their remedial powers. A person who resorts to self-medication also resorts to self-diagnosis. The proper diagnosis of a disease is one of the most difficult and important tasks of the physician. A layman cannot make a scientific diagnosis of his ailment. One of the chief dangers of self-medication is that it postpones proper medical treatment, thus permitting the disease to progress to the extent that irreparable damage may result. In regard to most nostrums, it may be said that the person who buys them is being exploited, i.e., he is "being played for a sucker." The results of self-medication are frequently tragic. The people of the United States spend more than two hundred million dollars per year in the purchase of drugs for self-medication. It should be understood by everyone that medicines do not offer a short cut to health, that they possess no miraculous powers and that very few have any curative powers.

SEDATIVE DRUGS

Among the most common self-drugging practices is the widespread use of drugs which act upon the central nervous system. Most of these drugs

produce a depressing effect and are commonly known as *sedatives*. Certain sedatives will relieve pain whereas others induce sleep.

Pain-relieving Drugs. Included among the pain-relieving drugs are aspirin, amidopyrine, antipyrine, phenacetin and acetanilid. There is more or less danger associated with the use of these drugs when taken without the supervision of a physician.

Aspirin, scientifically known as acetylsalicylic acid, taken occasionally may be quite innocuous to the average individual, but when taken frequently or in large doses it may produce toxic effects. Some people are hypersensitive to aspirin and suffer severe symptoms when they use it. It is often used in combination with other pain-relieving drugs.

Amidopyrine, antipyrine, phenacetin and acetanilid depress the heart and decrease the oxygen-carrying capacity of the blood. The continued use of these drugs may cause fatigue, anemia and loss of weight. Some pain-relieving preparations contain bromides. Continued use of such medicines gives rise to chronic poisoning in which there may be muscular incoordination, emotional instability, impaired memory and delirium.

Hypnotics. Drugs used to induce sleep are known as *hypnotics*. The most commonly used hypnotics are barbiturates which are derivatives of barbituric acid. The most important barbiturates include barbital (veronal), phenobarbital (luminal), pentobarbital (nembutal), dial, amytal, neonal, phanodorn and ipral. These drugs are powerful hypnotics and are habit-forming. Their uncontrolled use is fraught with considerable danger. In many states barbiturates are now sold only on prescription from a physician. Small doses generally allay nervousness and restlessness, and induce sleep when given at night. Larger doses may result in mental confusion on awakening. Because they frequently produce a temporary mental disorganization, barbiturate pills are sometimes called "goof balls," particularly in the underground drug trade.

The customary dose may fail to produce sleep in a person who has developed some tolerance for the barbiturates, but may produce sufficient mental confusion so that in the attempt to take some more of the drug the patient may take many more tablets and thus be accidentally poisoned. Overdosage may cause death by paralyzing the respiratory center in the brain.

Since the barbiturates are habit-forming, it is possible to become a sleeping pill addict. As the body becomes habituated to the drug, larger and larger doses are required to produce sleep. This eventually leads to serious symptoms, including mental deterioration. When barbiturates and

alcohol are taken together a synergistic effect is produced in that each increases the effect of the other; thus this may become a very dangerous combination.

Psychoneurotic persons are prone to become sleeping pill addicts. Psychologically normal individuals who have been given barbiturates during a long period of illness may also become habituated. Overdoses of sleeping pills cause an estimated one thousand deaths annually in the United States. Sleep-inducing drugs should be used only when prescribed by a physician, and only in the dosage and for the period recommended by him.

NARCOTIC DRUGS

Drugs known as narcotics produce a temporary sense of well-being called *euphoria*. Certain narcotics are used in medical practice to lessen pain and to induce sleep. The chief narcotics are opium, morphine, heroin and cocaine. Because these drugs are strongly habit-forming, a person who uses them repeatedly over a period of time becomes dependent upon them for the normal functioning of his body and for personal comfort. After addiction has developed, deprivation of the drug produces physical and mental torture.

Opium is the dried milky juice of the unripe seed capsule of a species of poppy plant which is native to Oriental countries. Addiction has been an important sociological problem in the Orient for centuries. Morphine is the chief active constituent of opium. Heroin is a morphine derivative. Cocaine is obtained from the leaves of a certain plant of South America. In the United States, morphine, heroin and cocaine are the chief narcotics used by addicts.

Because tolerance develops as a person becomes addicted to these drugs, the dose must be increased to produce the original effect. Most addicts no longer experience euphoria from the use of the drug but must continue to take it for the prevention or relief of withdrawal symptoms.

The importation, sale, dispensing and prescribing of these drugs is rigidly controlled by law. The Harrison Narcotic Act limits the use of narcotics to strictly medicinal purposes and prevents their indiscriminate use by the public.

Underground drug channels smuggle narcotics into the United States to sell them to addicts at fabulous prices. It may cost an addict twenty to thirty dollars a day to satisfy his need for the drug. It is apparent that the life of an addict is not happy for he lives in constant fear of being unable to obtain the drug and experiencing the torture of the withdrawal

symptoms. Narcotics are expensive not only in dollars and cents, but also in terms of health and life.

Once established, narcotic addiction becomes a medical problem. The United States Public Health Service maintains two hospitals, one at Lexington, Kentucky, and the other at Fort Worth, Texas, for the rehabilitation of narcotic addicts. The treatment involves reducing the daily allowance gradually down to a certain point and then stopping the use of the drug completely. However, this is only part of the treatment. To be effective the patient must be given psychiatric treatment to remove the emotional immaturity or instability that caused him to become a narcotic addict.

Marihuana, another narcotic drug, is one of the names of the hemp plant (*Cannabis sativa*), the flowering tops of which contain a powerful narcotic principle known as cannabin. The drug is used in the form of marihuana cigarettes. The practice has spread very rapidly so that now there are many marihuana addicts in the United States, most of whom are of high school and college age. Marihuana cigarettes are known in the underworld as "reefers" or "muggles" and sold surreptitiously, usually to the youth of our larger cities. This drug is a very dangerous one and has been called the "murderous narcotic" because it gives rise to impulses of destruction. There is at first a feeling of exaltation with a sense of well-being, followed by stimulation of the imagination. Space and time relations lose their value. It may give rise to a delirious rage in which the individual loses all power to control his behavior and is then in a mental state to commit criminal acts. Its continued use leads to physical and mental demoralization.

BENZEDRINE

Benzedrine (amphetamine) is a powerful stimulant to the central nervous system. It is used to combat sleepiness and the sensations of fatigue. Besides its effect on the nervous system it constricts the blood vessels and thus increases the blood pressure. Mild overdosage results in restlessness, inability to relax and insomnia. Larger doses cause overstimulation of the heart and nervous system, which may result in cardiovascular collapse and convulsions. Benzedrine is the active substance in so-called "pep" pills. It is habit-forming and a dangerous drug except when used in correct dosage by physicians for certain specific conditions.

ANTACID DRUGS

The body contains acids which play a necessary role in the processes of life. Hydrochloric acid is necessary for gastric digestion, lactic acid

plays a role in muscle activity and amino acids are essential for the construction of protein molecules. Some acids are waste products and are promptly eliminated from the body. The body also contains basic (alkaline) compounds of various kinds and maintains an equilibrium between acids and bases known as the *acid-base balance*. In the blood the acid-base balance is very delicately maintained. The blood is always slightly basic (pH 7.3 to 7.5) in reaction, life being impossible with acid or even neutral blood. The blood is well protected by substances known as buffers which combine promptly with any excess acids or bases. The average diet provides the necessary compounds to maintain the acid-base balance. Nature has provided a wide range of safety so that when the food intake provides an excess of acid-producing over basic substances the buffers in the body maintain a correct balance between them.

It is folly to worry about "an overacid condition of the body" as we are so frequently encouraged to do by untruthful advertising, especially over the radio. The use of alkaline chemicals is not without danger. If used frequently they may do harm to the kidneys, since the work of removing this foreign material from the body falls on them. Alkaline chemicals interfere with gastric digestion since they neutralize the hydrochloric acid of the stomach. Persistent users of alkalis may acquire a condition known as *alkalosis* in which the body is unable to maintain the acid-base balance due to the large alkaline intake.

ALCOHOL

Contrary to public opinion, alcohol is not a stimulant but acts as a depressant of the central nervous system. The apparent stimulant action results from its inhibiting effect on the higher mental controls which normally exercise a restraining power on human behavior. The release of this restraint leads to a form of conduct that may appear to be the result of stimulation.

Alcohol is readily absorbed from the stomach and intestine into the blood stream, which carries it to all parts of the body. In the tissues of the body 90 to 99 per cent of the alcohol is oxidized to carbon dioxide and water, yielding usable energy. Each gram furnishes 7 kilocalories of energy.

Experiments have revealed that alcohol increases neither mental nor physical abilities. It impairs the faculties of attention, judgment and discrimination, and reduces muscular coordination. Activities involving speed and accuracy are carried on with reduced efficiency. Memory and mental concentration are impaired. The skin becomes flushed due to an increased amount of blood flowing through it. Although this gives a

sensation of warmth, it increases the heat loss from the body and the internal temperature may fall. Although alcohol reduces efficiency it gives the individual confidence and the erroneous impression that he is mentally alert and physically efficient.

The habitual use in large quantities of alcoholic liquors such as whiskey, gin or brandy may do serious damage to the stomach, liver, blood vessels, kidneys and nervous system.

Alcohol is responsible for much crime, many accidents and much bodily and mental injury and disease. The general use of the automobile at present makes it important to consider the effect of alcohol in relation to driving efficiency. Even a small quantity of liquor lowers reaction time, i.e., the ability of muscles and nerves to react quickly, which in an emergency may make the difference between safety and an accident. Alcohol befogs the judgment and in larger amounts makes drivers reckless and seriously impairs their driving ability. Seven to 10 per cent of all fatal highway traffic accidents are attributed to alcohol.

Since alcohol impairs judgment and reduces mental restraint and self-control, a person who wishes to retain full control over his behavior should abstain from the use of intoxicating beverages. In the words of Oliver Wendell Holmes, "I think self-narcotization and self-alcoholization are rather ignoble substitutes for undisturbed self-consciousness and unfettered self-control."

There is no satisfactory scientific evidence concerning the effects of the moderate use of alcoholic beverages on longevity, but life insurance statistics definitely indicate that heavy drinkers have a shorter average life than moderate drinkers and abstainers.

Modern psychology interprets the chronic alcoholic as a maladjusted, unstable person who seeks escape from the stern realities of life by drugging himself with alcohol. The use of alcohol offers a psychological escape from worries, anxieties, frustrations, social restraint and self-criticism.

REHABILITATING THE ALCOHOLIC

Alcoholism is one of our major public health problems because of the damage it does, the large number of persons involved and also because of its effect on society. About 3,750,000 of our people are excessive drinkers or inebriates. Of this number 750,000 to 800,000 are known (from hospital and court records) to be chronic drinkers.

The rehabilitation of the chronic drinker is a complex problem which involves the treatment of the total personality in its particular social setting. Since the alcoholic is a maladjusted person rehabilitation requires

not merely the treatment of his drinking but also the personality inadequacies which caused him to become an uncontrolled drinker.

There are a number of agencies engaged in the study of alcoholism, the publication of literature dealing with the alcohol problem and the rehabilitation of alcoholics. The National Committee for Education on Alcoholism (2 East 103rd St., New York 29, N.Y.) issues literature on alcohol, and assists communities in dealing with alcoholism as a public health problem. The Research Council on Problems of Alcohol (60 East 42nd St., New York 17, N.Y.) carries on research projects and assists communities in establishing treatment centers for alcoholics. The National Committee on Alcohol Hygiene (2030 Park Ave., Baltimore 17, Md.) issues booklets and a bimonthly publication "Alcohol Hygiene." The Laboratory of Applied Physiology of Yale University has established two clinics, one at New Haven and one at Hartford, Connecticut, for the psychiatric treatment of alcoholics. The work of these clinics has met with considerable success and has demonstrated the value of a sound psychiatric approach to the problem of the chronic drinker. Alcoholics Anonymous (P.O. Box 459, Grand Central Annex, New York 17, N.Y.) is a voluntary fellowship of 60,000 rehabilitated alcoholics organized for the purpose of helping others cure themselves of the alcohol habit. This organization has made an important contribution to the understanding of the problem of excess drinking and claims a recovery rate of 50 to 70 per cent of those who have made a sincere effort to cooperate with it. Having been rehabilitated themselves, the members of this organization are in a position to understand fully the alcoholic individual, his feelings of tension, frustration, guilt and resentment, and can, therefore, take an attitude of tolerance, patience and confidence toward him. Local branches have been established in many communities, making help from this organization available to many individuals.

TOBACCO

Tobacco is the dried leaf of a native American plant technically known as *Nicotiana tabacum*. Early Americans learned the use of tobacco from the native Indians. The most active ingredient of tobacco is *nicotine*, which in concentrated form is a very potent poison. There are other toxic substances in tobacco smoke, some of which are products of combustion and distillation; among these are pyridine, collodine, lutidine, ammonia, carbon monoxide and furfural.

The chief physiologic effects of smoking tobacco are: (1) elevation

of blood pressure, due to constriction of blood vessels; (2) increase in heart and pulse rates; (3) increased concentration of blood sugar; (4) increase in the basal metabolic rate; (5) drop in skin temperature due to constriction of the blood vessels in the skin, especially of the arms and legs; and (6) a sedative action on the nervous system. These effects are produced chiefly by the nicotine absorbed into the blood stream from the mouth, throat or lungs. Since smoking elevates the blood pressure and increases the heart rate, it adds to the work of the heart. In a person with heart disease or high blood pressure smoking may be decidedly harmful. The increase in the basal metabolic rate may keep an underweight person from gaining needed weight. It may also contribute to chronic fatigue. Local irritation of the lining of the throat, hoarseness and a disagreeable dryness of the tongue may result from excessive smoking, due to irritating substances other than nicotine present in tobacco smoke.

The amount of nicotine in smoke depends upon the degree of combustion; the more complete the combustion the greater is the destruction of nicotine. Combustion is most complete in cigarettes, less so in cigars and least in a pipe. The water content of tobacco is an important factor relative to the nicotine content of the smoke. In dry tobacco combustion is more complete and, therefore, a greater destruction of nicotine occurs than in moist tobacco. When smoke is inhaled much more of its nicotine content is absorbed into the blood stream because of the large surface area presented by the lungs. One who chews tobacco absorbs more nicotine than one who smokes it.

The scientific evidence available tends to support the view commonly held by athletic coaches, that smoking tobacco decreases athletic performance and endurance. The unfavorable physiologic effects of tobacco are of greater significance in the adolescent than the mature individual. Excessive use of tobacco is decidedly detrimental to health; it may cause palpitation of the heart, commonly called "tobacco heart," disturb digestion and impair the functioning of the nervous system. Smoking when the stomach is empty, as for example before breakfast, may irritate the lining of the stomach sufficiently to cause gastric disturbances eventually.

It has not been established definitely that the moderate use of tobacco is harmful to people in general, but statistical data gathered by Raymond Pearl, of Johns Hopkins University, suggest that the use of tobacco definitely lessens one's chance for a long life in proportion to the amount of tobacco used. Heavy indulgence in tobacco is associated with greatly curtailed longevity.

QUACKS AND MEDICAL CULTS

One must be cautious and critical, when in need of medical treatment, in selecting a member of the healing art. Only highly qualified members of the regular school of medicine should be considered. The scientific physician is guided by established truths. Unfortunately there are quacks among members of the recognized medical profession. A quack is a pretender to medical knowledge, skill, and merit to which he is not entitled. Quacks prey upon the ills and misfortunes of the people for their own personal profit. They often advertise in newspapers. It is against the ethics of the medical and dental professions to advertise. Physicians and dentists who advertise should be viewed with suspicion.

The modern healing art is afflicted with many unscientific cults. Despite the marvelous accomplishments of scientific medicine in the conquest of disease, it has been unable to keep the American public from being exploited by inadequately trained members of healing cults. Most of these cults have very low standards of education. A proper scientific education is the most important factor in the training of practitioners who can correctly diagnose and treat disease. The "evidence" the cults offer for their methods of treatment consists of testimonials which, as has been previously explained, do not constitute scientific evidence.

Some persons feel that they are benefited by receiving treatment by a member of one of the healing cults. A person experiencing a minor nervous disorder that has no organic basis can usually be benefited temporarily, if not permanently, by any type of treatment provided he has confidence in the practitioner. The power of the mind over the body is such that even when there is organic impairment a person is often benefited temporarily by treatment administered by a member of any healing cult if he has confidence in the practitioner.

QUESTIONS FOR CLASS DISCUSSION

1. Are people easily misled in matters pertaining to health and disease?
2. What is meant by the scientific method? Of what value is it to mankind?
3. Explain why the type of reasoning expressed by the phrase, "After it; therefore because of it," is erroneous.
4. Does inability to reason logically have a bearing on health?
5. Do testimonials constitute scientific evidence? Explain.
6. Does the misinformation conveyed to the public through advertising channels endanger the health of the people? Explain.
7. Are so-called "patent medicines" a boon or a menace to the people? Explain.
8. How do so-called patent medicines compare in quality with standardized medicines used by reputable physicians?

9. Is it ever advisable for a person to diagnose his own ailments and prescribe the remedy?
10. What direct dangers are associated with self-medication?
11. Give examples of pain-relieving drugs used extensively by the American public.
12. What dangers are associated with the use of pain-relieving drugs?
13. What are hypnotic drugs?
14. Why should one avoid self-medication with the barbiturates?
15. What are narcotic drugs? Give examples.
16. What dangers are associated with the use of narcotic drugs?
17. What is meant by the acid-base balance of the body?
18. Is it ever necessary to "alkalize" the body? Explain.
19. What are the physiologic effects of alcohol?
20. What is alcoholism?
21. What relation exists between the use of alcohol and automobile accidents?
22. What harmful substances are present in tobacco and tobacco smoke?
23. What are the physiologic effects of smoking?
24. What is the relation of the use of tobacco to length of life?
25. What precautions should one take in choosing a physician when in need of medical treatment? Why avoid members of healing cults?

TOPICS FOR ORAL OR WRITTEN REPORTS

1. Make a list of the advertisements of drugs for self-medication which you hear over the radio or see in a newspaper, for a period of a week. Tabulate the drugs as sedatives, cathartics, cold remedies, antacids, pain-relievers, etc. Evaluate the advice received.
2. Report on those provisions of the Federal Food, Drug and Cosmetic Act that pertain to drugs.
3. Investigate nonmedical practitioners of the healing art. How do they differ in their methods from the medical practitioner? Are their procedures scientifically established? Are they a help or a hindrance to human well-being?
4. Inquire into the relation of alcohol to vice and delinquency.

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CHAPTER 18

Infection



AN infection is a disease resulting from the invasion of the body by rapidly multiplying microscopic forms of life. It manifests itself by disturbed function. The invading organism is referred to as the causative or etiologic agent of the disease. Noninfectious diseases are due to factors other than invasion of the body by microorganisms. Among these are dietary deficiencies, such as scurvy; deranged metabolism due to endocrine disturbances, of which diabetes is an example; and degeneration of organs (heart, kidney, etc.) due to age or wrong habits of living.

Most of the infectious diseases are transmitted by natural means from one person to another; i.e., they are *communicable*. Those that are transmitted readily by personal contact are commonly called *contagious diseases*. When a disease runs a short course followed by death or recovery it is said to be *acute*, while the term *chronic* is applied to a disease characterized by a gradual development of symptoms and prolonged illness.

The human race has had a long and arduous struggle to survive against infectious disease. From the remotest periods of antiquity to the present time man has been ravaged by disease. Plagues and pestilences have stalked the earth and have scarred human history and altered its course. For untold centuries man was helpless against his death-dealing microbial foes.

The world of microorganisms was discovered in the seventeenth century by Anthony van Leeuwenhoek, a Dutch lens maker, who by the use of a crude microscope of his own construction was the first man to see and describe bacteria. Many years later it was found that microorganisms are the causative agents of many of the diseases of man, animals and plants. This was one of the great achievements of modern times. The work of Louis Pasteur of France and Robert Koch of Germany in the nineteenth century, laid the foundation of our present-day understanding of the role of microorganisms in the production of disease.

INFECTING ORGANISMS

The organisms that cause infection are chiefly microscopic in their dimensions, most of them being one-celled forms. The world has a very extensive and physiologically diversified population of microorganisms. Although exceedingly small, these organisms constitute a potent force in the world of life and in the affairs of man. Not all microorganisms are capable of causing disease. Many live on dead organic matter and for the most part carry on activities beneficial to man. Through the operation of various kinds of microorganisms, the organic matter in the soil is converted into plant food. Those organisms that are instrumental in pro-



Fig. 45. Various forms of bacteria. (Frobisher, Fundamentals of Bacteriology.)

ducing disease are collectively referred to as *pathogens* and are popularly known as germs or microbes. Although pathogens constitute only a small fraction of the total micropopulation, they are nevertheless man's most dangerous natural enemies. The greatest struggle of the human race has been its struggle to cope with infectious disease.

Microorganisms may be divided into six groups: (1) bacteria, (2) protozoa, (3) yeasts, (4) molds, (5) Rickettsiae, and (6) viruses. Each group contains pathogenic forms.

Bacteria. Bacteria are of three main types in regard to form: rod-shaped, spherical and spiral. Some are so small that they are near the limit of the resolving power of the optical microscope. The bacteria are by far the most numerous of all microorganisms. More than 1100 species have been described. They are classified as members of the plant king-

dom, but may be regarded as being intermediate between plants and animals since they possess characteristics of each kingdom. The dividing line between plant and animal is often vague and indeterminable in the realm of microscopic life.

A bacterium that is spherical or nearly spherical in form is known as a *coccus* (plural, *cocci*) ; the rod-shaped type is called *bacillus* (plural, *bacilli*) ; the spiral or corkscrew-shaped type is known as *spirillum* (plural *spirilla*) . The more specific name, *spirochete*, is applied to those spirilla that have a flexuous rather than rigid body.

Among the cocci there are forms which are grouped characteristically in pairs; such an organism is known as a *diplococcus*. One that forms chains of cells is known as *streptococcus*, and if the grouping is in the form of irregular clusters, resembling a bunch of grapes, the term *staphylococcus* applies.

The unit for measuring microscopic objects is the *micron*, which is a part of the metric system of linear measure, having a value of 0.001 of a millimeter, or roughly $\frac{1}{25,000}$ of an inch. For the measurement of viruses a still smaller unit is used. This is the millimicron which is equivalent to 0.001 of a micron. Cocci vary in size from 0.5 to a little more than 1 micron in diameter. Magnified one thousand times some cocci appear no larger than a period on a printed page. Many bacilli are between 2 and 3 microns long and 0.5 micron thick. Spirilla vary considerably in length from a few to about 10 microns.

Some bacteria can transform themselves into dormant bodies known as *spores*. In the process of spore formation the protoplasm of the cell becomes condensed into a relatively small ovoid or spheroid body which becomes surrounded by a tough, impervious wall. Bacterial spores are highly resistant to heat, the drying action of the air and chemical disinfectants. They are unique in the living world since no other forms of life can tolerate the high temperatures spores are able to withstand. With a few exceptions bacteria in their ordinary or vegetative stage (active stage) are killed when exposed to a temperature of 70° C. (158° F.), but spores can usually withstand the temperature of boiling water. There are only a few pathogens that produce spores. The existence of spores must be taken into consideration in the canning of food and in the process of sterilization. Under favorable conditions spores become transformed into vegetative cells.

Bacteria are the etiologic agents of such diseases as tuberculosis, gonorrhea, syphilis, pneumonia, lockjaw, typhoid fever, brucellosis, scarlet fever and diphtheria.

Protozoa. Structurally the *protozoa* are more complex than the bacteria. They vary greatly in size, most of them being considerably larger than the bacteria. Protozoa are classified as the lowest members of the animal kingdom. Malaria, amebic dysentery and African sleeping sickness are examples of diseases caused by protozoa.

Yeasts. Most of the common *yeasts* are somewhat larger than the bacteria and are generally ovoid (egg-shaped), but some are spheroid in form and a few have an elongated sausage-like shape. A few species of yeasts are pathogenic for man. Most of the diseases they cause are relatively uncommon.

Molds. The *molds* constitute a heterogenous group of fungi. A typical mold consists of many units or cells arranged in the form of a branched system of slender filaments. Some molds are pathogenic, but the diseases they cause are relatively uncommon except "athlete's foot," which affects many individuals.

Rickettsiae. The *Rickettsiae* comprise a group of small bacteria-like forms which were named in honor of their discoverer, Howard Ricketts, an American bacteriologist. Some are spherical in form, others are rod-shaped. They are of smaller dimensions than the bacteria, usually measuring less than 0.5 micron in length. They lie near the lower limit of visibility of the optical microscope. The *Rickettsiae* constitute a small group, all members of which apparently are pathogenic. The chief diseases caused by these agents are typhus and Rocky Mountain spotted fever.

Viruses. The term *virus* has been applied to the smallest etiologic agents of disease. They are too small to be visible under the optical microscope but have been observed under the electron microscope. Although exceedingly small they vary considerably in size, ranging from 10 to 300 millimicrons. Our knowledge of viruses is still very incomplete. Although they manifest some of the attributes of life in that they are capable of multiplying and causing disease, it has not been established that they are actually alive. It has been learned that some viruses are simply protein molecules and thus do not have a cellular organization. Whether or not the larger viruses are cellular in structure is not known. It is possible that the viruses represent transitional forms between living and nonliving matter. Apparently all viruses are pathogenic. Their minute size does not keep them from being powerful disease-producing agents since they are the causative factors of many diseases.

Among the common diseases due to viruses are the common cold, influenza, poliomyelitis, smallpox, rabies, mumps, measles, chickenpox, fever blisters and yellow fever. It is apparent that viruses are of immense significance among the pathogenic agents.

THE INFECTIOUS PROCESS

When pathogens gain entrance to body tissues and grow and multiply there, they may disturb the normal physiologic processes of the body. The harmful effects are due chiefly to soluble toxic (poisonous) substances known as *toxins*, liberated in the tissues of the body by the infectious agents. The damage may be local or general or both. Although the organisms may remain localized at the point of invasion, the body as a whole may experience the effects of their presence due to the distribution of the toxin through the body by the blood and lymph. Susceptible tissues such as the heart, nervous system, kidneys or other structures may be damaged. A local abscess, for example, may give rise to fever, accelerate the heart rate and cause other symptoms. This action on the part of pathogens evokes an immediate response on the part of the body by a process which, in its main lines of strategy, includes attempts to destroy the invading organisms and to neutralize the toxic substances produced by them. The various chemical defensive substances produced by the body are known collectively as *antibodies*. The maneuvers on the part of the body directed against the infectious agents may check or modify the infection.

In some instances the microbial toxins are not highly potent but, nevertheless, alter the course of events of normal tissue metabolism. In certain infections, however, the toxins are endowed with great potency and seriously disturb the functioning of the body. The harm done to the body may be manifested by symptoms such as fever, nausea, malaise, skin rash and diarrhea. A local tissue change caused by disease is known as a *lesion*. The branch of medical science which deals with the nature of disease, particularly with the structural and functional changes caused by disease, is known as *pathology*.

Infection usually involves the establishment of an inflammatory process. This is an important defense reaction since it is directed toward localizing, destroying and removing the infectious agents. In the first stage of the process the small blood vessels (capillaries) in the area become engorged with blood. The increased amount of blood in the region causes redness (hyperemia) which can be observed if the inflammation is near the surface. Increased permeability of the capillary walls permits a relatively large amount of the fluid portion (plasma) of the blood to escape into the infected area. This causes swelling. Pain is usually present, due to irritation of the sensory nerve endings. The coagulation of the escaped blood plasma causes the infected area to become walled off from the surrounding tissues, thus preventing the spread of the germs to other parts of the body. Simultaneously with the increased flow of blood to the affected area, white blood corpuscles in large numbers pass through

the capillary walls into the infected area to attack and engulf the invading organisms. Many infections are accompanied by a rise in body temperature known as *fever*. This is interpreted as a defense reaction on the part of the body. The rise in temperature appears to be disadvantageous to the invading organisms but increases the rate at which the body produces chemical substances to counteract the infection.

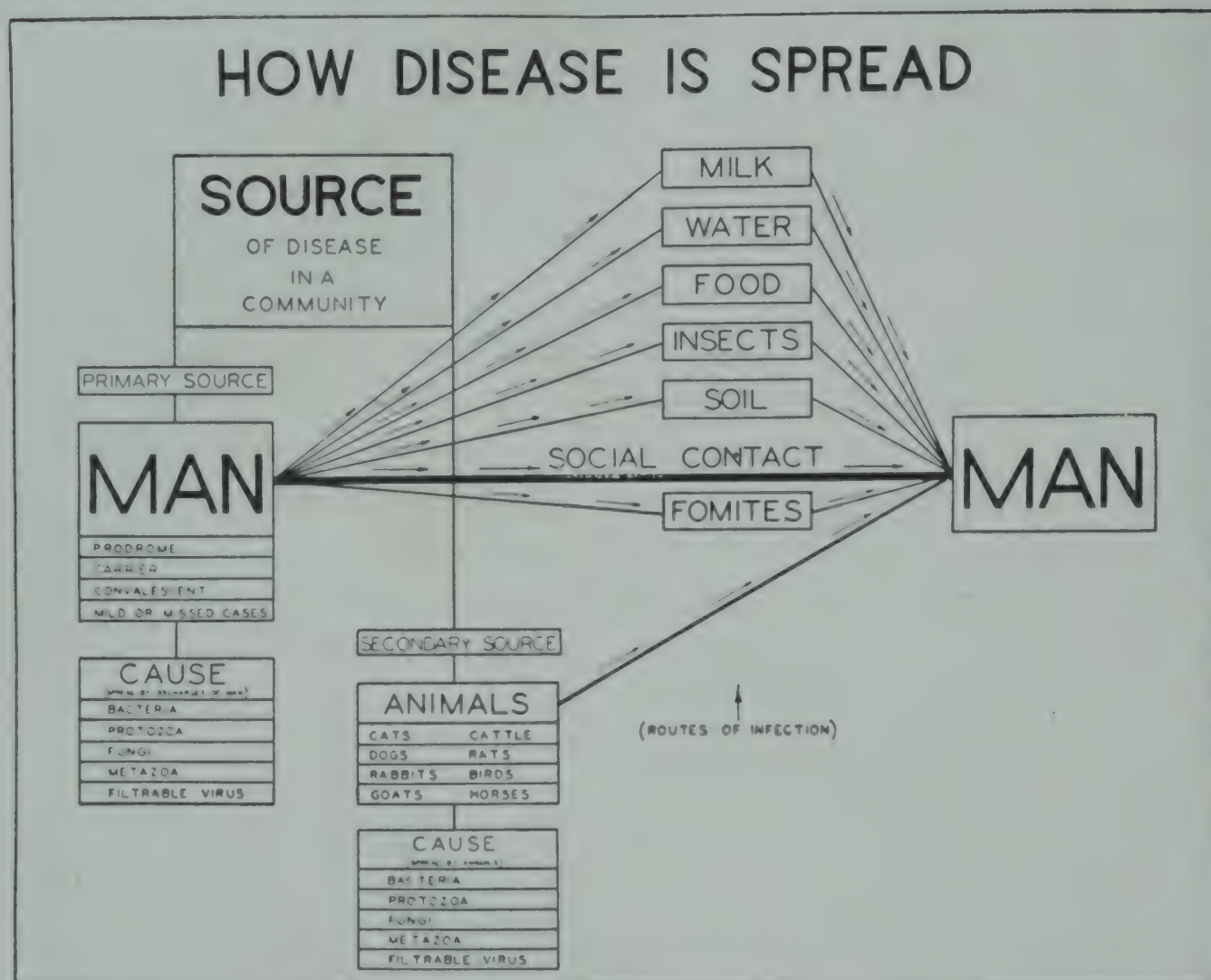


Fig. 46. Sources and spread of disease. (From Langton, Orientation in School Health. Courtesy of Harper & Brothers.)

SOURCES OF INFECTION

For each infectious disease there is (1) a source or reservoir of the specific causal agent, (2) a mode of transfer to, and ingress into, the body of a susceptible host, and (3) an escape route from the infected host. The existence of infection and its dissemination represents a chain reaction. If one of the links is eliminated, the cycle of events involved in the production of infection is interrupted. Knowledge concerning these points has been obtained in regard to many of the infectious diseases, and has had a profound effect on the development of preventive measures.

Very few species of pathogens are capable of living outside of the body of the host for any length of time. Many of the organisms that cause

disease in man are strictly human pathogens which cannot live apart from the human body. The body of man, therefore, is the reservoir of the agents of these diseases. Man is also susceptible to a number of diseases which occur chiefly in animals. The causative agents of these diseases thus have more than one natural habitat, but the animal hosts as a rule constitute their chief reservoir. Animal reservoirs of pathogens capable of infecting man are chiefly arthropods (insects and their kin), birds and mammals. Diseases such as rabies, parrot fever (psittacosis), rabbit fever (tularemia), plague, Rocky Mountain spotted fever and brucellosis are primarily animal infections and occur in man only because of the existence of animal reservoirs. They are not as a rule transmitted from man to man, but from animal to man.

Human reservoirs are those individuals who are suffering from disease and those who are carriers. A *carrier* is a person who harbors and discharges pathogens but does not exhibit the symptoms of disease. Carriers are a source of great danger to others and add to the difficulties of man's fight against disease. Attention is now being focused on carriers for they are the most important reservoirs of the causal agents of disease. Since it is not generally known which individuals are carriers, it is practically impossible to avoid associating with them. Carriers serve as reservoirs for the organisms causing typhoid fever, dysentery (bacillary and amebic), diphtheria, scarlet fever, meningococcus meningitis, pneumonia and numerous other diseases.

ESCAPE OF PATHOGENS FROM THE HOST

During the course of an infectious disease the causative organisms are expelled from the body, often in enormous numbers, through various avenues of excretion. Escape is essential for the perpetuation of the organisms. If there were no way for some of the infecting agents to leave the body of the host during the course of infection and enter a second host, the continued existence of pathogenic agents could not be maintained. The avenue of exit depends largely upon the region of the body in which the organisms are active.

Pathogens that cause disease in the respiratory tract are eliminated through droplets coughed or sneezed out by the patient. Examples of organisms eliminated in the discharges from the nose and mouth are diphtheria bacilli, the streptococci of scarlet fever and septic sore throat, pneumococci, tubercle bacilli, and the viruses of influenza, smallpox, mumps and measles.

Intestinal discharges (feces) serve as pathways of exit for the organ-

isms causing the intestinal infections of man, the more noteworthy examples being typhoid, paratyphoid, dysentery and cholera germs. Typhoid and paratyphoid bacilli in some cases also leave the body in the urine, which serves also as an avenue of exit for the organisms causing brucellosis.

In diseases such as malaria and yellow fever the causative agents are confined to the blood stream from which escape would be impossible were it not for the fact that mosquitoes, by sucking blood from the host, may transfer the germs to another host. Secretions from the genital tract provide a mode of exit for gonococci while the secretions of lesions of the skin and mucous membranes serve as exits for a number of different kinds of pathogens.



Fig. 47. High speed photograph of unstifled sneeze. (Courtesy of M. W. Jennison, Dept. of Plant Sciences, Syracuse University.)

TRANSFER OF INFECTION

After infecting organisms have escaped from the host they must gain entrance to a new host in order to survive. The transfer from one host to another may be direct or indirect.

Direct Transfer. In most infectious diseases the organisms are able to pass from the patient or carrier to another person without being conveyed by an intermediate object. Direct transfer does not necessarily imply actual physical contact. The inhalation of infective material expelled by another person by coughing, sneezing, laughing or talking is a form of direct transfer.

Droplets of moisture extruded from the respiratory tract into the surrounding environment may remain suspended in the air for many hours. Air serves as an agency in conveying infection only through relatively short distances, probably up to about 15 ft. At greater distances the infectious agent is subject to an enormous dilution factor which greatly reduces the hazard of infection. Examples of diseases that may be transmitted through infective droplets are the common cold, pneumonia, influenza, tuberculosis, diphtheria, scarlet fever, measles and whooping cough.

Indirect Transfer. Pathogens capable of surviving for a period of time outside of the body may be transferred indirectly from one person to another through inanimate objects or materials contaminated with the discharges of a patient or carrier. The vehicles of transfer may be water, food, soil, objects of various kinds as well as certain insects and related organisms.

Water polluted by sewage may transmit the organisms of certain intestinal diseases. In former years water-borne epidemics of typhoid fever and dysentery were common occurrences and are still a constant threat to health in many parts of the world.

Many kinds of pathogens may find their way into milk, some coming from diseased cows, others being derived from infected human beings or carriers who handle the milk before it reaches the consumer. Infected cows may contribute such organisms as streptococci, tubercle bacilli (bovine type) and those that cause brucellosis. From human sources milk may acquire the organisms of diphtheria, scarlet fever, tuberculosis, dysentery and typhoid fever. Milk can be made safe for consumption by the process of pasteurization which involves heating to a temperature of 142 to 145° F. for thirty minutes.

Food handlers who are carriers of infectious organisms may transfer them from their mouths, noses, skin or bowels to food which will be consumed by family groups in their homes or by the patrons of restaurants or other eating establishments. In some communities persons whose occupations necessitate the handling of food must submit to a special medical examination for the purpose of ascertaining whether or not they are carriers of pathogenic organisms.

Two diseases which man may acquire from the soil are tetanus (lock-jaw) and gas gangrene. The mode of life of the spore-bearing bacteria responsible for these diseases is not ordinarily that of pathogens. Their normal habitat is the intestines of horses and other domestic animals, where they live without doing harm. When the spores reach the soil in

excrement they may remain alive indefinitely and if they gain access to a wound may germinate into vegetative cells on dead or injured tissue. Here they produce very potent toxins which produce the symptoms of these diseases.

Animal vectors, chiefly insects and their kin, may transfer disease to man. Malaria is transmitted by a number of species of mosquitoes belonging to the group known as *Anopheles*, while yellow fever is conveyed by a single species of mosquito (*Aedes aegypti*). Plague (bubonic form) is transmitted to man from rats by the bite of rat fleas. Typhus is transmitted by the human body louse. The common house fly spreads disease by conveying infecting organisms from body excreta to human food. The diseases it transmits are chiefly typhoid fever and dysentery. It is particularly dangerous in rural communities where it has ready access to human excrement.

PORTALS OF INVASION

To produce infection it is necessary that pathogens gain entrance to the body tissues through a portal which they are able to utilize. The portal of entrance is of great importance in determining whether or not disease shall occur. Each kind of organism is as a rule more or less dependent on a particular channel of entry. A few species are adapted to enter by two or even three different portals. To produce typhoid fever, the etiologic agents of this infection must enter the body via the mouth to reach the intestines. The bacteria causing tetanus may be swallowed without harm but when they gain access to a wound they may establish themselves there and cause disease.

The chief portals of entry are: (1) the respiratory tract, (2) the alimentary tract, (3) the integument or skin and (4) the genitourinary system. Infections of the respiratory tract are among the most common and dangerous of human infections. Included in this category are the common cold, influenza, the various pneumonias, pulmonary tuberculosis, diphtheria, scarlet fever, pneumonic plague and whooping cough. The alimentary tract is the invasion channel for the organisms causing typhoid fever, paratyphoid fever, dysentery, Asiatic cholera and some types of tuberculosis.

The intact skin is seldom invaded by infecting organisms, but passive introduction through the skin by way of breaches, abrasions, penetrating instruments or the bites of arthropods is frequent. Mechanical force such as rubbing may force pathogens present on the surface of the skin into hair follicles and the ducts of sweat glands. Wounds furnish a suitable

portal of entry, particularly for staphylococci, streptococci, tetanus bacilli and the bacilli of gas gangrene. The more important infections caused by organisms that utilize the skin as an avenue of entrance are: acne, boils, carbuncles, erysipelas, impetigo, athlete's foot, tetanus, gas gangrene, rabies, tularemia, Rocky Mountain spotted fever, typhus fever, malaria and yellow fever.

The urethra, vagina, uterus or other parts of the genitourinary system may be invaded by certain pathogens. The genitourinary tract is the common invasion route of the spirochetes of syphilis and gonococci, the causal organisms of gonorrhea. Occasionally other pathogens gain entrance to this part of the body.

COURSE OF AN ACUTE INFECTION

Infectious disease is a dynamic process; from a slow or sudden beginning it progresses, reaching in many cases a peak and finally ending, in the case of an acute disease, in recovery or death. The course of an acute infectious disease may be divided into three distinct stages: (1) incubation period, (2) period of active disease and (3) convalescence.

The incubation period represents the time lag between the invasion of the body by the pathogenic agents and the first manifestations of the symptoms of the disease. During this period the invaders must overcome the defenses of the body to a sufficient degree so that they may increase in numbers and establish themselves in the tissues of the host. The incubation period varies considerably in length in different diseases, being very short in some (one to two days) and long in others (three months or more). In typhoid fever the incubation period is from seven to fourteen days; in scarlet fever, from one to seven days; in smallpox, from five to seven days; in influenza, from one to four days; in syphilis, from three to four weeks; and in rabies, from one to three months or longer.

The period of active disease follows the incubation period. During this period the symptoms manifest themselves and the strife between the pathogens and the host continues until the pathogens or the host has won the struggle. In acute diseases this period is short, usually a week or two but in chronic diseases such as tuberculosis, leprosy and malaria it may last for months or years.

If the defensive forces of the host gain the ascendancy, convalescence sets in during which the invaders are gradually eliminated, damaged tissue repaired and bodily functions returned to their normal state. In some cases the pathogens are not completely eliminated and the individual then becomes a carrier of the disease.

QUESTIONS FOR CLASS DISCUSSION

1. What is meant by the term "infection?"
2. Define the following terms as they apply to disease: (1) communicable, (2) contagious, (3) acute, (4) chronic.
3. Who discovered the world of microorganisms? When?
4. Define: (1) microorganism, (2) pathogen.
5. Name the six groups of microorganisms that contain pathogenic forms.
6. Define: (1) coccus, (2) bacillus, (3) spirillum, (4) spirochete, (5) diplococcus, (6) micron, (7) millimicron.
7. What are bacterial spores?
8. How do the Rickettsiae and viruses differ from other agents of disease?
9. Describe the infectious process.
10. What is meant by the "inflammatory process?"
11. What are the sources of infection?
12. Name the chief animal reservoirs of pathogens capable of infecting man.
13. What is a disease carrier? Name diseases often transmitted through carriers.
14. How do pathogens escape from the body? Of what significance is this?
15. Explain the transmission of infection by direct contact. What is meant by droplet infection?
16. What are indirect modes of transfer?
17. Name the portals of invasion.
18. Explain the course of an acute infectious disease.

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CHAPTER 19

Body Defenses Against Infection



ALTHOUGH microorganisms are constantly present on the skin and in the body cavities that open to the exterior, they do not usually invade the tissues of the body. The human body possesses defense mechanisms to keep microorganisms from entering its tissues. If this external bulwark fails, permitting microbes to gain entrance to body tissues, the body's internal defenses enable it to wage counterattacks against the invaders. Every animal, by virtue of the fact that it is alive, possesses defenses which keep it from being vanquished by microorganisms. This is a fundamental biologic property. The capacity for defense is a natural physiologic function and a very important adaptation to environment, as necessary for survival as the process of digestion or respiration. After death this defense is gone, and all the tissues of the body are promptly invaded by a wide variety of microorganisms.

The protective mechanism of the body, as indicated above, may be divided into two types: (1) external defenses, which constitute the outer barriers of the body, preventing microorganisms from invading the tissues; and (2) internal defenses which protect the body after invasion has occurred.

OUTER BARRIERS OF THE BODY

The external defenses consist of the skin and the mucous membranes. These two structures belong to the category of epithelial tissues which are tissues that cover surfaces and line cavities. The skin forms a protective covering for the body, and the mucous membranes line the body cavities which open to the exterior, such as the entire alimentary tract from mouth to anus, the respiratory tract, and the genitourinary system including the pelvis of the kidneys. The epithelial tissues constitute the first line of defense, i.e., the primary defense of the body. They function as a very effective barrier to invasion.

The Skin. Although microorganisms are numerous on the skin they rarely penetrate it. The skin offers mechanical as well as chemical pro-

tection. The outermost layers of the skin consist of flat, more or less hard cells, the hardness being due to an insoluble protein known as keratin. These cells are no longer alive since their protoplasm has been replaced with keratin. The keratinized cells make the normal skin quite impermeable to bacteria. The skin contains hair follicles and sweat glands which open on the surface. It is through the hair follicles and ducts of the sweat glands that microbes may at times invade the intact skin and cause infection; this is particularly true of staphylococci which are usually present on the skin. A slight scratch on the skin, even if it is only microscopic in its dimensions, provides an open portal for invasion.

The Mucous Membranes. Healthy mucous membranes also resist the passage of most microorganisms. These membranes contain cells (goblet cells) which secrete mucus, a slimy, sticky fluid, in which microorganisms that come in contact with it become trapped.

Some mucous membranes secrete an enzyme-like substance which has the power to dissolve (lyse) some microorganisms. This substance, known as *lysozyme*, is present in the nasal secretions, the secretions of the mouth and in the tears produced by the lacrimal glands associated with the eyes. The tears have a very high lysozyme content.

Penetration of the Outer Defenses. Although the outer defenses of the body constitute an efficient safeguard, they are not an absolute protection. Microbes occasionally penetrate these bulwarks and enter body tissues or the blood stream. They may enter the skin by way of the ducts of the sweat glands, the orifices of hair follicles, scratches, cuts, abrasions or the bites of insects. Also, they may gain a foothold on mucous surfaces, causing sufficient damage by toxic secretions to enable them to invade the tissues. The body, therefore, in order to survive, requires further defenses against those organisms which occasionally penetrate its primary defenses.

INTERNAL DEFENSES OF THE BODY

When microbes succeed in getting through the outer bulwark of the body and enter the tissues they encounter the second line of defense. The strategy of this defense is to hamper and destroy the invaders and thus keep them from establishing themselves in body tissues. This defense operates in two ways: (1) through the agency of cells known as *phagocytes*, which include certain of the white corpuscles present in the blood, lymph, lymph nodes and other parts of the body; and (2) through the production of counteracting chemical substances called *antibodies*, which are capable of destroying infectious agents and their toxic products.

Phagocytes. Phagocytes constitute the body's prime agency for destroying microorganisms that have passed its external barriers. They are continuously on guard to protect the body. This type of defense is known as *phagocytosis*. In the case of most diseases, recovery would be impossible without the process of phagocytosis. When infection occurs there is a mass movement of phagocytes to the site of infection. Those in the blood stream pass through the capillary walls into the spaces of the infected tissue. A combat ensues between the phagocytes and the invaders. By means of finger-like processes (pseudopodia) which they can project, they engulf and destroy microorganisms. The toxic products of the pathogens may, however, destroy many of the phagocytes. Because of this, a large number of phagocytes may be required to overcome an infection. The process of phagocytosis cannot proceed without the collaboration of certain chemical substances known as *opsonins*. The mode of action of opsonins is not fully understood; it is known, however, that they act upon the invading microbes, rendering them amenable to attack by phagocytes. Opsonins are normally present in the body but when infection occurs the quantity is augmented by the production of large amounts of highly specific opsonins which will enable the phagocytes to attack the particular kinds of organisms that have invaded the body.

Antibodies. In many infections the process of phagocytosis alone will not vanquish the microbial foes. Additional defenses are frequently needed and are produced in response to the presence of the invading organisms or their toxins. Such chemical defensive substances are known as *antibodies*. The invading foreign substance that serves as the stimulus causing the body to produce antibodies is called *antigen*, the word being a contraction of the term "antibody-generator." The true nature of antibodies is not fully understood. Chemical tests indicate that they are modified globulins. Globulins constitute one of the two chief proteins of the blood. The opsonins mentioned previously are also apparently globulins. Antibodies are usually classified on the basis of their action: one reacting against and thus neutralizing microbial toxins is an *antitoxin*; if it causes the pathogens to clump together it is an *agglutinin*; a *precipitin* acts on soluble microbial proteins which have entered the blood stream or lymph, by precipitating them; an antibody that causes lysis (dissolution) of bacterial cells is referred to as a *bacteriolysin*.

ROLE OF HEALTH IN RESISTANCE TO INFECTION

There are factors which augment or lower resistance to infectious disease which apparently are not directly concerned with the specific body

defenses just considered. Persons who maintain a high standard of health, are well nourished, obtain adequate rest and recreation and live in good surroundings are in general more resistant to infection than those whose health standards and living conditions are on a lower level. Diets which are deficient either qualitatively or quantitatively predispose to infection. It has been shown experimentally that pronounced deficiency of vitamin A in the diets of animals lowers resistance to infection. Prolonged fatigue has been found definitely to lower resistance, and chilling of the body surface of animals causes a marked increase in susceptibility to infection.

A high level of health, however, apparently is not a factor in making one less susceptible to such diseases as smallpox, typhoid fever, measles, diphtheria, rabies, gonorrhea and syphilis, although it may protect one against some of the complications of these diseases.

TYPES OF IMMUNITY

Immunity to infectious disease refers to the ability to combat pathogens successfully after they have invaded the body, and thus forestall the development of disease. Immunity may be *inborn* or *acquired*. Inborn immunity is an inherent characteristic possessed from the time of birth. Acquired immunity, as the name implies, is not inherent but develops through some incident after birth. It may be attained actively or passively.

Actively Acquired Immunity. If immunity results from a response on the part of the body to the presence of antigen, it is said to be actively acquired. Under such conditions the tissues of the body become active and make specific antibodies to react with the antigen. The immunity may be acquired (1) naturally, through recovery from an infection, the antigen entering the body by natural means; or (2) artificially, by the deliberate introduction of antigen into the body. Some examples of diseases in which recovery confers immunity are typhoid fever, typhus, plague, smallpox, scarlet fever, tetanus, diphtheria, measles, mumps and poliomyelitis. Although usually permanent, immunity acquired in this manner is not necessarily absolute; a second attack may occur in some individuals.

Active immunity against a number of diseases can be conferred on susceptible persons by deliberate introduction into the body of specific antigenic material in the form of living or killed microorganisms or toxins. An immunizing preparation containing microorganisms is referred to as a *vaccine*. In the case of some diseases immunity can be produced by inoculating susceptible persons with bacterial toxins. At the present time toxins are usually modified by treatment with formaldehyde,

and are then known as toxoids. This treatment destroys the toxicity of toxin but not its antigenic properties.

Passively Acquired Immunity. Passively acquired immunity is produced by injecting into the body the blood serum of an animal which has been actively immunized to a very high degree to the disease. Such blood serum contains specific antibodies similar to those produced in the human body during disease, and is known as *antiserum*. In some cases the blood serum of a human being who has recently recovered from a particular disease is used.

Since no antigen is introduced in this type of immunization, the body is not stimulated to make antibodies but is the passive recipient of antibodies produced in the body of an animal, such as the horse, goat or rabbit, or in some cases, the body of another person. The immunity produced is of short duration, lasting usually not longer than four weeks. Because it is immediately effective this method of immunization is used chiefly to treat rather than to prevent disease, i.e., it is employed as a curative agent.

IMMUNIZATION

It has become a common public health practice to immunize individuals artificially to safeguard them from certain infectious diseases such as typhoid fever, smallpox, diphtheria, pertussis (whooping cough) and tetanus. Immunization has been one of the factors that has made life less hazardous than it was in the past. It has practically eliminated smallpox and diphtheria from many communities. To assure potent and safe products, the commercial production of immunizing preparations offered for sale in interstate commerce is under the supervision and control of the United States Public Health Service.

IMMUNITY THROUGH VACCINATION

Vaccines are suspensions of either living or killed infectious microorganisms, usually in a physiologic salt solution (0.85 per cent salt). If the organisms are alive they have been treated to reduce their virulence; i.e., they have been attenuated. When injected into the body the microorganisms in the vaccine serve as antigen, stimulating the body to produce antibodies and thus acquire active immunity.

Typhoid Vaccine. Typhoid vaccine may be taken as an example of a vaccine containing killed organisms. To make the vaccine, typhoid fever bacteria are grown on the surface of a suitable culture medium and then washed off with and suspended in a sterile physiologic salt solution. The

bacteria are killed by heating to 55° C. The vaccine is standardized to contain one billion bacteria in each cubic centimeter. It is administered by giving three subcutaneous (or intracutaneous) injections at intervals of five to seven days. The first injection consists of 0.5 cc. (one-half billion bacteria) and the second and third of 1 cc. each (one billion bacteria). It is advisable that persons who are likely to come in contact with cases or carriers of typhoid and those who plan to visit a region where typhoid is prevalent be immunized against this disease. The immunity produced by typhoid vaccine has a duration of about two years.

BCG Vaccine. This vaccine is made from an attenuated strain of tubercle bacilli. It has been widely used in European and South American countries for the immunization of children against tuberculosis. Recent tests carried on in the United States and Canada have produced convincing evidence of the value of the vaccine.

Smallpox Vaccine. This vaccine is a glycerinated suspension of the attenuated virus obtained from the skin pustules of inoculated calves. It was the first vaccine to come into use. Its effectiveness for the prevention of smallpox was first demonstrated by Edward Jenner, an English physician, in 1796. The immunity produced by this vaccine wears off slowly over a period of years. It is recommended that the initial vaccination be made during the first year of life, a second vaccination at the age of six years, and subsequently at every known exposure to the disease. Vaccination within four days after exposure usually protects against the development of infection. Some authorities advise a third inoculation about ten years after the second one. A high level of immunity can be maintained through frequent vaccination.

Influenza Vaccine. Influenza virus vaccine is a suspension of inactivated virus prepared from virus cultures grown in chick embryos. There are a number of strains of the influenza virus, the total number being still unknown. The vaccine now in use offers some protection against the more common strains. The protection is of short duration, lasting not longer than a year.

Other Vaccines. A number of other vaccines are in use, including those that produce immunity to whooping cough, rabies, yellow fever and Rocky Mountain spotted fever. It has not been possible to prepare effective vaccines for all infections.

IMMUNITY BY USE OF TOXINS AND TOXOIDS

Only a few kinds of pathogens produce the kind of toxin that can be used for immunization. To obtain the toxin, the bacteria are grown in a

liquid culture medium for a number of days. The bacteria are then removed by filtration through a porcelain filter, the fluid portion passing through the filter contains the toxin produced by the bacteria. Immunization may be accomplished by injection of toxin in nonlethal doses, or by the injection of toxoid. Diphtheria toxoid is used to immunize children against diphtheria. It is recommended that infants between the ages of six and nine months be immunized against diphtheria and that they receive a booster dose of toxoid three years after the original immunization. By community-wide immunization of infants, diphtheria can be completely subjugated. Diphtheria toxoid may be combined with whooping cough vaccine to immunize a child against both whooping cough and diphtheria simultaneously.

Tetanus toxoid is effective in producing immunity to tetanus. It was used to immunize the members of the armed forces of the recent war with the result that very little tetanus occurred, whereas in previous wars tetanus frequently developed in wounded men. Tetanus toxoid is sometimes combined with diphtheria toxoid and thus simultaneously a child may be immunized against both of these diseases. After the initial tetanus immunization another injection of toxoid should be given at any time the person sustains a deep puncture wound or a badly soiled laceration.

IMMUNITY BY USE OF ANTISERUMS

Antiserums are prepared by the injection of specific antigen into such animals as horses, goats or rabbits. The antigen used for this purpose is either a bacterial toxin or cultures of specific pathogens. The presence of the antigen stimulates the production of antibodies in the body of the animal. When the antibody concentrate has reached a satisfactory level, the animal is bled. The blood thus obtained is allowed to clot and the serum (liquid portion) is drawn off and filtered through a porcelain filter. The serum is partly purified and is then known as antiserum. It is not possible to produce antiserums against all infections. Many of the microorganisms that are pathogenic for man will not serve as antigen in the bodies of animals and consequently do not cause them to produce antibodies. An antiserum in which the antibody is an antitoxin is commonly called antitoxin.

Antiserums are usually employed to treat rather than to prevent disease. They are used for such diseases as diphtheria, tetanus, pneumonia, botulism, dysentery and infections caused by certain strains of streptococci and staphylococci.

OTHER CONTROL MEASURES

Immunization procedures are not the only available methods for the control of infectious diseases. The maintenance of a sanitary environment is of considerable significance in holding certain diseases in check. Diseases now controlled by sanitation took an enormous toll of human life in former years. Sanitation is the best means of controlling diseases spread by water, food and insects. The sanitary disposal of sewage is important to keep it from polluting the water supply of a community. Sewage may contain the germs of typhoid fever, dysentery (both amebic and bacillary), and pathogenic streptococci.

The provision of a sanitary water supply offers a high degree of control over typhoid fever, the dysenteries and other intestinal infections. The destruction of breeding places for mosquitoes by draining marshy areas, the oiling of stagnant waters and the use of insecticides are important control measures for malaria. The elimination of all breeding places for flies is an aid in preventing the spread of a number of diseases.

The sanitary handling of food, including its production and distribution, reduces the risk of spread of disease through food. The pasteurization of milk is particularly important since raw milk is frequently the vehicle of infection of a number of diseases. The proper washing of dishes is a necessary part of food sanitation. Improperly cleaned eating and drinking utensils constitute a health hazard since such utensils may harbor pathogenic microorganisms. Numerous investigators have revealed that eating and drinking utensils, especially in public eating establishments and taverns, carry mouth organisms. Surveys carried out in several sections of the United States have demonstrated the presence of streptococci, staphylococci, tubercle bacilli, diphtheria bacilli, mouth spirochetes and other pathogens on freshly washed utensils. Methods used in many eating establishments for the washing and disinfection of utensils are far from meeting the standards that should prevail. Some cities and states have ordinances and laws which stipulate the procedure to be used. Many community health departments have established courses of instruction to familiarize kitchen and service personnel of eating establishments and other food handlers with the principles of food sanitation.

Personal cleanliness is a valuable practice from the point of view of disease prevention. Since the majority of pathogens enter the body through the mouth and nose, it is essential to keep the hands away from these parts of the body. Due to the many objects they touch during the course of a day, the hands are very likely to become contaminated with microbes of various kinds. Putting the fingers to the nose or mouth

or moistening them with saliva before turning the pages of a book gives many opportunities for the transfer of such microbes to the mouth and nose. The hands should be washed thoroughly before each meal, after caring for the sick, and after the use of the toilet.

A large amount of sickness appears to be due to infection made possible by poor nutrition. A well-nourished body has considerable resistance to disease-producing microorganisms. Any practice that impairs the general health tends to lower resistance to infectious disease.

HEALTH PRACTICES TO BE ACQUIRED

1. Maintain a high general resistance to infection by keeping yourself at a high level of health.
2. Avoid exposure to infection whenever it is possible to do so.
3. Maintain immunity to smallpox by being vaccinated at regular intervals.
4. Be immunized against typhoid fever if you live in an area or travel in regions where typhoid is prevalent.
5. Keep your immediate environment in a sanitary condition.
6. Take an interest in sanitation in general and work toward a high level of sanitation in your community.

QUESTIONS FOR CLASS DISCUSSION

1. Which body structures constitute the external defense against invasion by microorganisms?
2. What characteristics does the skin possess that makes it a good defense against invasion?
3. What enables the mucous membranes to resist invasion?
4. What internal defenses against pathogens does the body possess?
5. What are phagocytes? Of what significance are they?
6. Define: (1) phagocytosis, (2) opsonins.
7. What are antibodies?
8. Explain the terms: (1) antigen, (2) antitoxin, (3) agglutinin, (4) precipitin, (5) bacteriolysin.
9. Discuss the role of health in resistance to infection.
10. Explain the meaning of the term "immunity."
11. Distinguish between active and passive immunity.
12. State the ways in which immunity may be actively acquired.
13. What is a vaccine? A toxoid?
14. State how passive immunity may be conferred.
15. What is an antiserum?
16. Name diseases for the prevention of which vaccines are available.
17. Which diseases can be prevented by means of toxoids?
18. Name diseases for the treatment of which antisera are available.
19. Discuss sanitation as a means of controlling disease.
20. Is adequate nutrition a factor in disease prevention?

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CHAPTER 20

Infectious Diseases



ALTHOUGH man has made great progress in his fight against disease, many of the diseases that took a heavy toll of life in the past are still great killers. Others have been effectively subjugated by sanitation or immunizing procedures, but constant vigilance is necessary to keep them under control. Most people still die prematurely from disease instead of succumbing to the decadence of old age. In the present chapter essential facts about certain infectious diseases are presented in the hope that such information will assist the individual in taking measures to protect himself against them.

THE COMMON COLD

A cold is the commonest of all infectious diseases and is by far the most common cause of absence from school and work. It is spread by the secretions of the nose and throat of infected persons. The common cold is a contagious disease caused by one of several kinds of viruses. It is characterized by an acute inflammation of the mucous membrane of the upper respiratory tract, mainly of the nose and throat. The disease develops usually from twelve to seventy-two hours after exposure to a case. Individual susceptibility to colds varies greatly; a few never have colds while others have four or five a year. A survey made by the United States Public Health Service has shown that the average person in the temperate zone has two colds a year.

An acute cold is a self-limited disease of four or five days' duration. When properly taken care of the disease usually is not dangerous in itself, but when neglected or in debilitated persons it may lower the resistance of the mucous membranes of the upper respiratory tract sufficiently to permit other germs to set up secondary complications such as sinusitis, middle ear infection, bronchitis or pneumonia. The germs of pneumonia are often normal inhabitants of the nose, mouth and throat and increase rapidly in the throats of persons with acute colds. It is particularly impor-

tant that a person who has a cold should avoid becoming overfatigued or getting wet and chilled.

A person with a cold should show consideration for others and avoid spreading his infection. To keep his hands and articles handled by him from becoming contaminated he should collect the discharges from the nose and throat in paper napkins which may be burned, thrown into the toilet or otherwise disposed of. He should wash his hands frequently, especially before mealtime, and use an individual towel. It is advisable to stay at home and rest when one has a cold.

Although we have no certain means of preventing colds, the following rules may be helpful:

1. Establish good health habits so that the general vitality of the body will be maintained.

2. Adopt an adequate dietary in which milk, fruits, fresh salads, green and other vegetables are included.

3. Become outdoor-minded and obtain daily outdoor recreation. Fresh air and sunshine exert a tonic effect on the body and fortify its resistance to disease.

4. Accustom the skin to changes in temperature by daily baths, especially cold or cool baths. Air baths are also of value. These baths help the skin to retain its normal tone and vigor, and its function to control properly the temperature of the body. Proper temperature control prevents derangement of the circulation and congestion of the mucous membranes of the nose, throat, bronchial tubes and lungs.

5. Obtain an adequate amount of sleep in a well-ventilated bedroom.

6. Keep the indoor air from rising above 70° F. when artificial heat is used. Confinement in overheated rooms apparently is an important predisposing factor in the causation of colds.

7. Wash hands thoroughly before eating and keep them away from mouth and nose.

8. Avoid close contacts with those who have respiratory diseases and keep out of their spray when they cough and sneeze.

9. Avoid the use of towels, handkerchiefs and drinking glasses used by others.

10. Avoid cold and damp feet.

INFLUENZA

Influenza, commonly referred to as the "flu" or "grippe," is a highly contagious disease of the respiratory tract. The disease is caused by a virus of which several strains have been isolated. Most cases are due to

infection with either the A or the B strain. These viruses can be cultivated in chick embryos. The disease is transmitted through the respiratory discharges of infected individuals. The incubation period is usually two to three days. Influenza occurs in a variety of forms. The milder forms do not differ greatly from a severe cold. In fact, any acute respiratory illness which is not pneumonia but is more severe than an ordinary cold is usually called influenza. We do not have a clear definition of influenza.

Influenza is self-limited and of short duration. The usual symptoms are fever, malaise, body pains and marked prostration. Although influenza has an exhausting effect on the body, when uncomplicated it seldom causes death. The chief danger lies in the complications which are frequently associated with it. It is often complicated with pneumonia which terminates fatally in a high proportion of cases. Other complications are heart damage and nephritis.

In the past there have been many epidemics and pandemics of influenza. The pandemic of 1918–19 was particularly severe, killing more than 20,000,000 human beings. Between epidemics influenza occurs sporadically.

A recently developed vaccine containing both the A and B strains of the virus is now available. It is made from inoculated chick embryos. Although this vaccine appears to be of value in temporarily engendering some degree of immunity, it cannot be relied upon completely. When an epidemic occurs the individual should avoid unnecessary contacts, especially contacts with persons afflicted with respiratory infection. A person afflicted with influenza should go to bed at the beginning of the attack and be under medical care. This may prevent the development of complications.

TUBERCULOSIS

In 1882 Robert Koch, a German physician, announced that he had discovered the causative organism of tuberculosis and offered specific proof that it was the etiologic agent of the disease. The organism is a slender rod-shaped bacterium known scientifically as *Mycobacterium tuberculosis*, commonly called the *tubercle bacillus*.

The disease is spread chiefly by means of the sputum of tuberculous patients. Minute droplets of sputum expelled by a patient in coughing, sneezing or spitting may remain suspended in the air for a considerable period of time and be inhaled by others or they may contaminate food. The disease is also spread by the inhalation of dust arising from dried sputum.

Whether or not the tubercle bacillus can establish itself in the body to produce an active infection depends very much upon the condition of the person. Factors which interfere with the normal physiologic well-being of the body predispose it to infection with the tubercle bacillus. Under-nourishment, overfatigue, irritation of the lungs by dust or gases are factors that favor the tubercle bacillus in establishing itself in the body.

More than any other organism, the tubercle bacillus causes widespread disease and death. In 1900 the tuberculosis death rate in the United States was 202 per 100,000 population; at the present time it is below 40. This decline is due to the concentrated attack that has been carried on against the disease for over forty years. Although the death rate has been declin-



Fig. 48. Tubercle bacillus. (Ford, Textbook of Bacteriology.)

ing steadily for many years, tuberculosis still contributes prominently to the mortality rate and still occupies first place as a cause of death in the age group of fifteen to forty-five years. For every death that occurs there are at least five active cases. Girls and young women between the ages of fifteen to twenty-five are more highly susceptible to, and more likely to die of, tuberculosis than boys and young men in this age group. After the age of thirty, however, tuberculosis kills more men than women.

Tuberculosis is a long-drawn-out and treacherous disease which in the early stages is usually symptomless. It may reach an advanced stage without the patient being aware of having the disease. The lungs are the common seat of infection but the organisms are capable of invading almost any body structure. It is possible to have tuberculosis of the bones, lymph nodes (particularly those of the neck and within the chest), larynx, spleen, intestines, liver, urinary bladder, kidneys and skin. About 90 per

cent of the deaths from tuberculosis, however, are due to the pulmonary type. In young children the bones, joints and lymph nodes are more commonly infected than in adults. Because of the frequency of pulmonary tuberculosis it has received the greatest attention and has been the basis of most investigations concerning the nature of the disease.

Tuberculosis occurs in two distinct phases: phase one, which is known as the *primary infection*, and phase two, called the *reinfection*. The primary infection represents the reaction of body tissues to the first invasion by tubercle bacilli. It is usually resisted so well by the defensive forces of the body that it causes only one or a few localized lesions in the lung tissues, and symptoms are usually absent. The infection is quickly held in check by the defense mechanism of the body which proceeds to form a wall of fibrous tissue around the lesions. Deposits of calcium salts are formed over the lesions.

In some parts of the world nearly all persons acquire the primary type of infection before they attain adulthood, but in the United States and a number of other countries only a small percentage of children become infected with tubercle bacilli. Because of this, primary tuberculosis develops more frequently in adults than in children. Although the primary infection is a benign disease, it sets the stage for the reinfection type of tuberculosis. Only a small percentage, however, of those who have had the primary infection acquire the reinfection type, which in most cases develops into chronic tuberculosis. The organisms which cause the reinfection may come from the individual's own primary lesions (endogenous reinfection) or from some other person (exogenous reinfection). Endogenous reinfection results from the breakdown of the fibrous tissues that have walled off the previously infected area. The bacteria in the second phase of the disease are growing in tissues which have become sensitized to the protein products of the tubercle bacillus. These proteins are poisonous to the tissues and give rise to inflammatory reactions which may be followed by death of the involved tissues.

In the reinfection type the presence of tubercle bacilli in the tissues gives rise to the formation of small characteristic lesions (small round masses) called *tubercles*, from which the disease gets its name. As the tubercles become numerous, adjacent ones often fuse into larger masses. Later the accumulation of toxic bacterial products causes death (necrosis) of the central portion of these lesions. This is followed by caseation (formation of cheeselike material). As the caseated masses become softened the material is coughed up as sputum, leaving cavities in the lungs. When this occurs the sputum contains tubercle bacilli. A person

in this stage is referred to as an “open” case. Occasionally the necrosis may include small blood vessels, resulting in hemorrhage of the lungs.

Pulmonary tuberculosis usually cannot be detected by symptoms until it is far advanced. The early symptoms are often vague and may simulate those of a number of other diseases. Even in some moderately advanced cases there may be no symptoms that would cause the individual to suspect that he has tuberculosis. The commonest signs of the disease are (1) a feeling of fatigue without apparent cause, (2) loss of weight and



Fig. 49. Chest x-ray apparatus. (Courtesy of Westinghouse Electric & Manufacturing Co.)

appetite, (3) a slight rise in body temperature in the afternoon, (4) night sweats, (5) frequent pains in the chest, (6) a persistent cough and (7) spitting up blood.

Since many persons have chronic tuberculosis without exhibiting any symptoms, it is essential in our combat against the disease to detect those who are infected. Case-finding has now become the front-line weapon against tuberculosis. In the past the tuberculin test was the first procedure in the diagnostic examination. It was used as a screening process separating the infected from the noninfected individuals. This was followed by x-ray examination of the chest of positive reactors. In recent years this has been largely reversed, the chest x-ray now being the screening pro-

cedure, followed by the tuberculin test for those who show shadows on the lungs. Mass chest x-ray surveys are now being conducted on a large scale throughout the United States for the detection of tuberculosis in its early stages. Mobile x-ray units are frequently used for this purpose. The new high-speed x-ray apparatus now employed uses films of small size. With this equipment the chests of virtually the entire adult population of the United States could be x-rayed in a short time at comparatively low cost. When the x-ray shows a shadow on the lungs, a second x-ray using a larger film is taken. If tuberculosis is indicated, the individual is given a tuberculin test.

Tuberculin, the preparation used in the tuberculin test, was originally prepared by Robert Koch in 1890. He made it by growing tubercle bacilli upon glycerinated veal broth. After a good growth was obtained, the bacteria were killed by heat and removed from the broth by filtration. The filtrate was concentrated by evaporation to one-tenth its original volume. Tuberculin prepared in this manner was in use for many years and is now known as Koch's Old Tuberculin. Proteins produced by the tubercle bacilli constitute the active substance in tuberculin. Most of the tuberculin now used is a purified preparation (purified protein derivative) containing proteins produced by tubercle bacilli in a special synthetic medium.

The tuberculin test is based on the characteristic response when tuberculin is introduced into the skin. The reaction is due to hypersensitiveness (allergy) to proteins of the tubercle bacillus. Individuals who have never been infected by the tubercle bacillus are not allergic to these proteins. A positive response is indicated by an area of redness and swelling at the point of application. A positive tuberculin reaction does not necessarily mean that the individual has active tuberculosis, but simply that somewhere in the body there is tissue infected with tubercle bacilli. The lesion may be very small or it may be a healed inactive area. A negative reaction is much more significant than a positive one.

Adequate treatment of recognized cases is an important part of the tuberculosis control program. In the majority of cases the disease can be cured if detected early; in more advanced cases it usually can be arrested by proper treatment. The most important factor in treatment is complete rest in bed. When at rest the individual breathes less often and less deeply. The reduced motion of the lungs promotes healing in the affected areas. An abundance of fresh air and a highly nutritious diet are also important parts of the treatment. In cases of tuberculosis of the bones and lymph nodes, sun baths are of great benefit but in pulmonary tuberculosis they may be harmful unless taken for only short periods. In ad-

vanced cases of the disease, collapse of the affected lung may be necessary. One way of accomplishing this is to force air into the thoracic cavity between the lung and the chest wall. The collapsed lung, being immobilized, is not involved in the breathing movements but remains in a state of rest which expedites healing. Streptomycin has been found to be of value in the treatment of certain cases of tuberculosis. It is most effective when used as an adjunct to the standard methods of treatment. Unfortunately the tubercle bacillus may acquire resistance to streptomycin.

The proper treatment of all cases of tuberculosis is of great importance in the fight against this disease. A patient under proper treatment is no longer a source of infection in the community, whereas untreated cases serve as disseminating reservoirs of tubercle bacilli.

To keep from acquiring tuberculosis one should maintain a high level of general health. Adequate nutrition is particularly important since a well-nourished body has considerable resistance against the tubercle bacillus. It is also important to avoid contact with active cases of the disease. Preventive vaccination with BCG (*Bacillus Calmette Guérin*) vaccine, prepared from an attenuated strain of tubercle bacilli, has received considerable attention in recent years. It has been used for many years in some European countries and is now gaining favor in the United States.

PNEUMONIA

Pneumonia is an acute infectious disease of the lungs. Most cases of the disease are caused by *Diplococcus pneumoniae*, commonly called the *pneumococcus*, which is a spherical bacterium usually occurring in pairs. The pneumococcus includes about thirty types of germs which have been designated by numbers. In some cases streptococci, staphylococci or other organisms are the causative agents. There are two main types of the disease, bronchopneumonia and lobar pneumonia.

Bronchopneumonia is usually a secondary infection following in the wake of measles, whooping cough, influenza, severe colds and other diseases. The onset is gradual and the infection is scattered through the lung.

In lobar pneumonia one or more of the five lobes (the right lung has three, the left lung two) of the lungs may be involved. The disease is usually primary and has a sudden onset with a severe chill followed by a steep rise in temperature. Pain in the side is common, a dry painful cough sets in and breathing becomes more rapid. The capillaries in the involved portions of the lungs become congested with blood and some of the fluid portion of the blood, together with red blood corpuscles, enters the air

sacs of the lungs. This exudate becomes fibrinous and leads to a consolidation of the lung tissue. Thus the functional area of the lung is decreased and the work of respiration is thrown upon the unaffected part. Due to the passage of blood into the lungs, blood-tinged or "rusty" sputum is raised. The temperature hovers around 104 or 105°; if no specific treatment is administered the patient remains in this condition for about seven days when the so-called "crisis" occurs and the patient either dies or undergoes a striking change for the better.

Although formerly a major cause of death, pneumonia is now curable. It was formerly treated effectively with antiserums after the specific type



Fig. 50. Pneumococcus. (Ford, Textbook of Bacteriology.)

of pneumococcus causing the infection had been determined. Now sulfonamide drugs and penicillin are used instead of specific antisera. These newer methods of treatment have greatly reduced the pneumonia death rate. The disease still takes a heavy toll, however, in infants under one year of age and in the aged.

A person in good health has a high resistance to the pneumococcus. It is only when this resistance becomes lowered that the organism can set up infection. Factors that lower resistance are infections of the upper respiratory tract such as the common cold and influenza, undue fatigue, starvation, exposure to wet and cold weather with chilling of the body, and alcoholic intoxication.

BRUCELLOSIS

Brucellosis or undulant fever is a disease caused by small rod-shaped bacteria belonging to the group known as *Brucella*. The disease is of

common occurrence in cattle, goats and swine, from which the organisms may be transmitted to man. The disease is widespread among cattle and is the most serious disorder that affects them. Man contracts the infection through the ingestion of contaminated raw milk and dairy products made from such milk, or through direct contact with infected animals and the handling of infected meat. The disease is of frequent occurrence among slaughterhouse workers who handle the carcasses of infected animals. Nearly all veterinarians get the disease sooner or later. Many farmers become infected.

Brucellosis in man is a disease of major importance. It is characterized by fever of an irregular nature, headache, joint pains, profuse sweating and irritability. The symptoms usually continue for three to five days and then abate. This is followed by a recurrence, hence the name "undulant fever," as the malady is frequently called. During the course of the acute phase of the disease there are usually from two to seven undulatory relapses. The patient loses weight, becomes greatly prostrated and extremely weak. The disease frequently becomes chronic and thus has a long duration, up to five years in some cases. In the chronic form the symptoms are usually very indefinite. The patient becomes mentally depressed due to worry and concern over his health and incapacity for work. Because these symptoms are suggestive of mental disorder, the chronic form of brucellosis is frequently erroneously diagnosed as "neurasthenia."

It has been estimated that the total number of cases occurring yearly in the United States is between 40,000 and 100,000. The death rate is low.

TETANUS

Tetanus, or lockjaw, is caused by *Clostridium tetani*, commonly called the *tetanus bacillus*. The organism is rod-shaped and produces highly resistant spores. Its normal habitat appears to be the intestinal tract of herbivorous animals, particularly the horse. The spores of the organism are present in soil fertilized with barnyard manure. From the soil, the spores may enter the air along with dust particles and may be conveyed to clothing, the human skin and common objects of various kinds in houses and other buildings.

The organism gains entrance to body tissues through wounds caused by objects which carry tetanus spores into the deeper tissues. Deep lacerated wounds in which there has been considerable tissue damage afford a suitable environment for the tetanus bacillus. Wounds which have become fouled with soil or road dirt are particularly likely to become infected with tetanus. There is always danger, also, of tetanus de-

veloping from gunshot wounds, nail puncture wounds and splinter injuries.

The disease is characterized by violent spasms beginning usually in the muscles of the jaw and neck. The jaws become set so that the patient is unable to open his mouth. It is for this reason that the disease is commonly called lockjaw. Later all of the muscles of the body undergo spasmodic contractions. The body becomes as rigid as a board and is often arched like a bow so that only the head and heels touch the bed.

An effective degree of active immunity may be achieved artificially by the injection of tetanus toxoid. This protection was administered to our

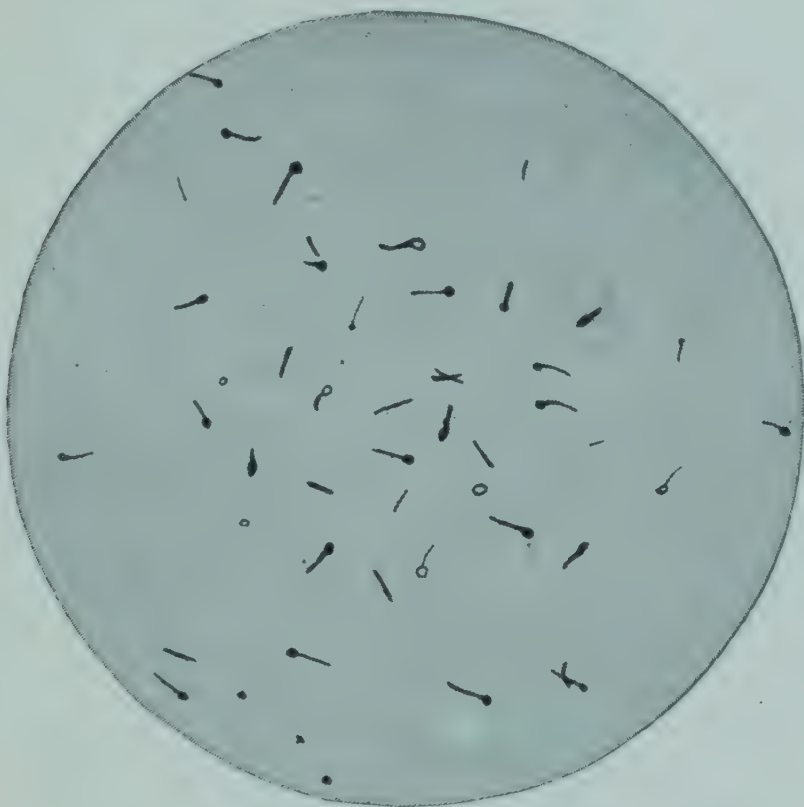


Fig. 51. *Clostridium tetani*. Note the terminal spores. (Frobisher, Fundamentals of Bacteriology.)

military personnel in the recent war with the result that tetanus was practically nil in our armed forces. An unimmunized person who has received a severe wound may be protected against tetanus by the use of tetanus antitoxin. The immunity thus produced is of short duration but if the antitoxin is administered shortly after the occurrence of the wound, it will usually prevent the development of the symptoms of tetanus. After the symptoms have set in, the efficiency of antitoxin as a curative agent is questionable.

TYPHOID FEVER

The causative organism of typhoid fever is *Salmonella typhosa*, commonly called the *typhoid bacillus*. The organism gains entrance to the body through food and drinking water contaminated with the feces or

urine of patients or carriers. The water supply of a community may become contaminated with untreated human sewage which frequently contains typhoid bacteria; milk may become contaminated by a carrier; flies who have recently fed on contaminated excreta may convey the organisms to foods of various kinds; oysters from contaminated estuaries may harbor typhoid bacteria and be a source of infection.

Typhoid fever is a generalized, rather complicated type of infection characterized by the presence of the bacteria in the blood stream and by

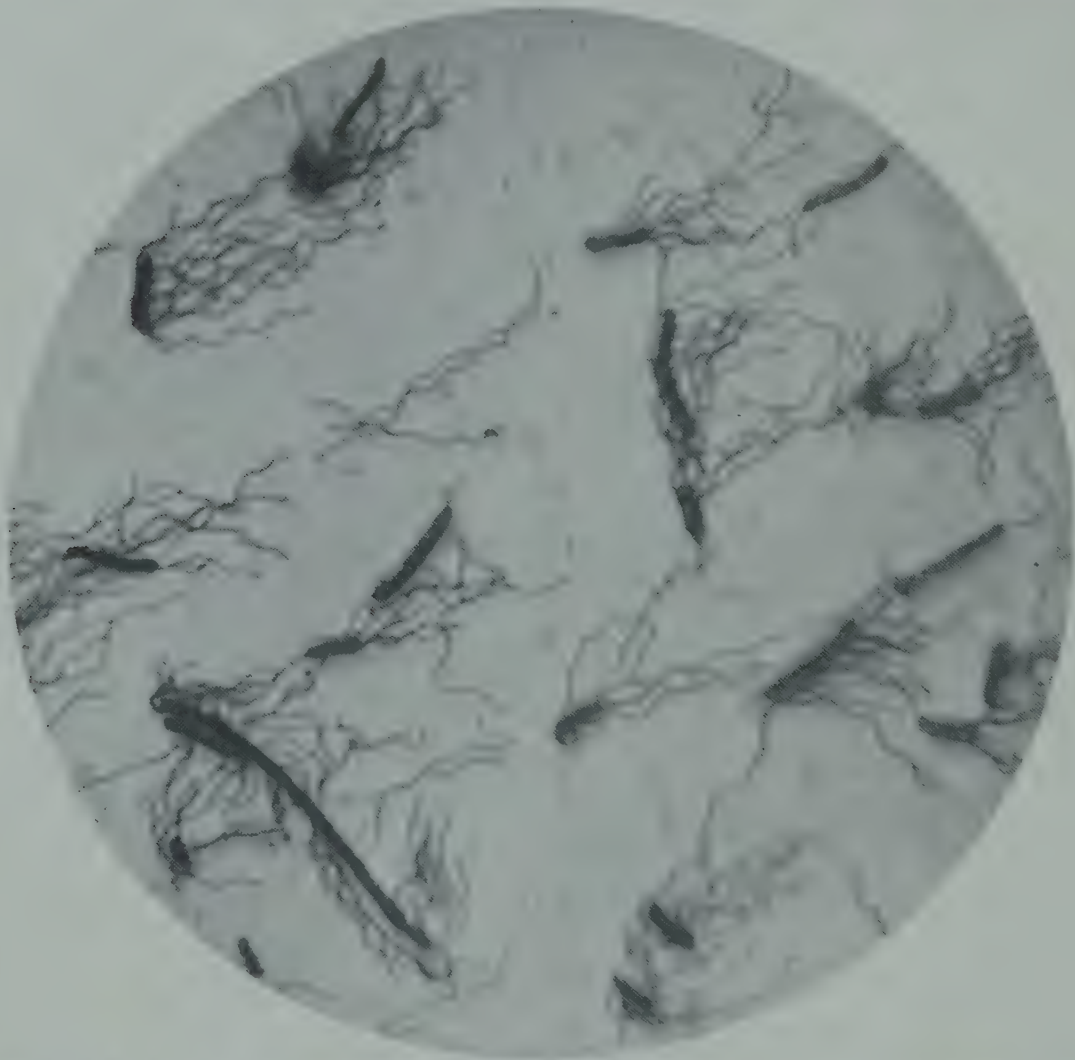


Fig. 52. Typhoid bacteria, treated to show whiplike threads (flagella) used for locomotion. (Courtesy of Denoyer-Geppert Co.)

localized areas of infection, including the intestine. Most patients continue to harbor and discharge typhoid bacteria for several weeks after the symptoms of the disease have disappeared. A small percentage of these individuals become chronic carriers, harboring and discharging the bacteria for years or even for life. The majority of chronic carriers are women. The handling of food by such persons may be a great source of danger to others. Many outbreaks of typhoid have been traced to carriers.

In former years typhoid fever was one of the major infectious diseases. The typhoid epidemics of the past were caused chiefly by polluted water

supplies and contaminated milk. The great progress that has been made in the establishment of modern water purification plants and the sanitary disposal of sewage, as well as the increasing attention that has been given to the sanitation of our food supplies, have been the chief factors in the decline of the incidence of typhoid fever and in its practical elimination from many communities. Vaccination of those likely to be exposed to the infection has also played a role in the conquest of the disease. The majority of cases that occur now in the United States are in the form of small scale epidemics in which an unknown carrier has been the source of the organism. The control of the typhoid carrier is now of major importance in bringing the incidence of the disease to the vanishing point.



Fig. 53. Diphtheria bacillus. (Ford, Textbook of Bacteriology.)

DIPHTHERIA

Diphtheria is caused by *Corynebacterium diphtheriae*, a rod-shaped bacterium commonly called the *diphtheria bacillus*. It is an acute, contagious disease characterized by local inflammation of the pharynx, larynx or upper trachea, and by the formation of a pseudomembrane in the air passages. Associated with the local infection are constitutional symptoms due to potent toxins elaborated by the bacteria. The disease is most common in children but may occur in any age. The mortality is greatest at ages below five. The incubation period is one to seven days. Highly virulent strains of the bacteria may kill their victims within twenty-four or forty-eight hours.

The disease is treated with diphtheria antitoxin. Its efficacy is unquestioned if given early in the disease. Under certain circumstances

penicillin is used as an adjunct in the treatment of the disease. Diphtheria antitoxin may be used also as a temporary preventive against the disease in the case of unprotected persons who have been exposed to the infection. Protection thus obtained does not last longer than two to four weeks. Children can now be actively immunized against the disease by means of diphtheria toxoid which is usually given in two doses at intervals of four to six weeks. It is advised that every infant between the ages of six and nine months be immunized and a "booster" dose administered three years later. In recent years millions of children have been immunized against diphtheria and the results have been remarkable.

In the past, the death rate from diphtheria was appallingly high; devastating epidemics were common throughout the world. At present the death rate for diphtheria in the United States is less than one per 100,000 population. We now have at our disposal the necessary weapon for the abolition of diphtheria.

SMALLPOX

Smallpox, once one of the most dreaded scourges that wiped out entire populations, has, by means of vaccination, become a relatively rare disease in many nations of the world. Although smallpox is now a totally preventable disease it has not been abolished, and in most of the world it is still a serious menace.

The causative agent of smallpox is a virus, of which there are at least two strains, one causing the malignant and the other the mild form of the disease. The death rate of the malignant form, which is common at the present time in India and the Orient, may be as high as 25 per cent. The mild form is found in all parts of the United States, but is seldom found in those states where vaccination is compulsory. The malignant form occurred in several of our states in 1924-1925 and again during the winter of 1945-1946. There is always danger that it will make a reappearance.

The smallpox virus enters the body through the respiratory tract and is present in the nose and throat secretions and the skin lesions of the patient. Practically every human being is susceptible unless he has had the disease or has been successfully vaccinated. The incubation period is usually between eight and ten days. The disease is characterized by fever, nausea, vomiting, prostration, sore throat and pain in the bones and joints. The early symptoms may be mistaken for influenza. After two or three days skin eruptions appear. They start as red spots, later become water blisters (vesicles) and then change over into pustules (pus-contain-

ing lesions). After the pus disappears they become dry and form scabs. Deeply pitted scars may remain as residual lesions. Recovery from the disease leaves the individual immune.

Vaccination against smallpox, introduced by Edward Jenner in 1796, is an effective method of inducing a state of active immunity which lasts for five or more years. Small epidemics of smallpox still occur in the United States because many people neglect or refuse to be vaccinated. In those states in which vaccination is compulsory by law, the disease is practically unknown. If none or only a small percentage of our people were vaccinated we would have a susceptible population which would be in great danger of being decimated by smallpox. It is inadvisable to look upon smallpox with complacency because of the small number of cases reported annually.

It is recommended that the first vaccination be made during the first year of life and a second one at the age of six years. When an outbreak of smallpox occurs in a community, it is advisable that the entire population be vaccinated or revaccinated. Vaccination within three or four days after exposure usually protects against the development of the infection.

QUESTIONS FOR CLASS DISCUSSION

1. Discuss the common cold in regard to (1) causative agent, (2) prevalence, (3) possible complications, (4) prevention.
2. What is influenza? How may it be prevented?
3. Explain the following points in regard to tuberculosis: (1) causative organism, (2) parts of the body attacked, (3) primary infection, (4) reinfection, (5) characteristic lesions, (6) symptoms, (7) diagnosis, (8) treatment, (9) prevention.
4. What is tuberculin?
5. Discuss pneumonia. What is the treatment? How may it be prevented?
6. How is brucellosis transmitted to man? What is the most important measure the average individual can take to keep from contracting this disease?
7. Explain the following points in regard to tetanus: (1) name and habitat of the causative organism, (2) how the organism enters the body, (3) symptoms, (4) immunization.
8. What procedure should be followed to immunize a child effectively against diphtheria?
9. Since smallpox is a preventable disease why has it not been eradicated from the United States?
10. What is the accepted procedure in regard to effective immunization against smallpox?

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CHAPTER 21

Noncommunicable Diseases



ALTHOUGH science has made great advances in the control of communicable diseases it has not made equal progress in the control of the noncommunicable maladies. The latter group of disorders include chiefly those that are commonly known as *degenerative diseases*. These chronic, or long-term ailments, result apparently from the wearing out or degeneration of body organs such as the heart, blood vessels, kidneys, pancreas and liver. The most important of the chronic illnesses are diseases of the heart, arteriosclerosis, apoplexy, high blood pressure, kidney disease, cancer, diabetes and arthritis. Certain noncommunicable diseases such as the allergies (hay fever and asthma) are not classified as degenerative diseases. The mass procedures that have been so successful in the past in the control of many of the communicable diseases cannot be employed in the control of the degenerative disorders. The degenerative diseases constitute our major health problems at present. Although most of these diseases appear most often during middle and late life, they may attack persons in any age group.

In regard to the causes of the diseases of degeneration, present-day scientific knowledge is insufficient to give us a satisfactory answer. There are reasons to believe that unhygienic living is the key to the problem. Some investigators believe that nutritional deficiencies are of particular significance in bringing about these disorders. It is a reasonable assumption that inadequate nutrition over a period of many decades will bring about the premature wearing out of body organs and tissues. Certain infections, particularly scarlet fever, diphtheria, influenza, rheumatic fever and syphilis, may do considerable damage to body organs and thus serve as predisposing factors to degenerative disorders. The stress of modern life may also be a factor. It is known that heredity is a contributing factor in the case of certain of these diseases.

Great progress has been made in recognizing the early symptoms of many of the degenerative diseases and in minimizing their disabling effects. Many of those afflicted can be restored to comparative health.

DISEASES OF THE HEART

Diseases of the heart lead all other causes of death in the United States. This is due largely to the fact that the lengthened average span of life allows more people to attain old age and thus become vulnerable to disorders of the heart. There has been a decline in heart trouble in youth and middle age in recent years. The term "heart disease" covers a variety of different cardiac afflictions. Some types, such as rheumatic heart disease and syphilitic heart disease, are involved with infections; others are associated with the blood vessels (coronary arteries) which provide the heart muscle with blood.

Rheumatic Heart Disease. Heart disease is a frequent sequence of rheumatic fever which is a disease of childhood and young adult life, occurring most frequently between the ages of five and fifteen. Apparently rheumatic fever is always preceded (from one to five weeks) by an upper respiratory infection such as sore throat, tonsillitis or scarlet fever, associated with hemolytic streptococci. Streptococci are, therefore, considered to be in some way causally related to rheumatic fever. The disease gets its name from the fact that the patient usually has a fever and the joints become inflamed as they do in rheumatism (arthritis). The joint inflammation and the fever subside after a short period of time. The most important and most serious feature of the disease is the fact that it usually affects the heart. There is a tendency for the initial attack to be followed by subsequent attacks, months or even years later. If the heart escapes one attack, it may be damaged by a succeeding attack.

All parts of the heart, the muscle, lining, valves and membranous covering, may become involved; when this is the case, the disease is usually fatal. Usually it is only the valves that are affected. They become inflamed and wartlike lesions form on them. When the inflammation subsides the valves become thickened and distorted, resulting in a permanently damaged heart. The valves may become misshapen to such an extent that they open only partially, thus impeding the flow of blood through the heart; also, they may be held in a more or less open position, allowing blood to be forced backward with each heartbeat. The heart thus is overworked, which ultimately may lead to heart failure. Rheumatic fever is the leading cause of death between the ages of five and nineteen, and in the age group of twenty to twenty-four is outranked only by tuberculosis. Thousands of members of the armed forces developed the disease in the recent war. Some patients die shortly after contracting the disease; many succumb within five years after acquiring the disease.

Rheumatic fever kills more children of school age than any other disease and makes invalids of many which it fails to kill. Some afflicted individuals attain adulthood before dying of heart failure. In some cases the heart escapes damage or the injury may be of such a minor nature that it does not appreciably handicap the individual.

The disease is most common in the temperate zone, occurring most frequently in the cold, wet seasons of the year. Contributing factors are poor housing, nutritional deficiencies and crowded living conditions. Unlike the streptococcus infections which precede it, rheumatic fever itself is not communicable. The casualty list can be reduced by improving the environmental conditions that serve as contributing factors, by the maintenance of good nutrition on the part of children and young adults, by prompt medical attention at the first sign of a respiratory infection, and by good medical treatment when rheumatic fever occurs. The prompt treatment of hemolytic streptococcal infections of the respiratory tract has been found to be a very important factor in lowering the incidence of rheumatic fever.

Syphilitic Heart Disease. Heart disease is a frequent complication of tertiary syphilis and a frequent cause of death. About one syphilitic in ten of those who do not receive proper treatment acquires a heart ailment as a consequence of his infection. The aorta, the main artery leaving the heart, and the heart muscle become invaded and weakened by the spirochetes of syphilis. The aorta may burst, causing sudden death.

Coronary Heart Disease. Coronary heart disease is the most frequent type of heart ailment from middle age onward. It may be due to a narrowing of the heart arteries (coronary sclerosis) or to the formation of a blood clot in a coronary artery (coronary thrombosis). In coronary sclerosis the arteries have been hardened and thus have lost some of their elasticity. Temporary spasms may occur in these arteries, causing them to constrict still further, thus seriously reducing the blood supply to the heart muscle. These spasms are accompanied by severe temporary chest pain which may radiate to the neck and arms. A heart condition of this type is called "angina pectoris." The attacks are usually of short duration, lasting only a few moments, but if prolonged may be fatal. In coronary thrombosis a blood clot (thrombus) blocks a coronary artery or one of its branches. It may cause sudden death if it blocks the blood supply to a large area of the heart muscle. If the area affected is not too large, a "collateral circulation" is usually established after a period of time, which detours the clotted artery and sets up new supply lines. Coronary thrombosis can now be treated with anticoagulants such as Dicu-

marol. These are of most value when administered the first day or two of the attack. It is often possible for a patient to live comfortably with coronary heart disease if he lives a life of moderation and is careful not to place too great a strain on his heart. A calm, optimistic attitude toward his condition is of great help in relieving an impaired heart of unnecessary strain.

DISEASES OF THE BLOOD VESSELS

The chief disorders of the blood vessels are arteriosclerosis and hypertension.

Arteriosclerosis. Arteriosclerosis (hardening of the arteries) is a disease in which the walls of the arteries become hardened and thickened. This results in loss of elasticity of the arterial walls and usually narrows the channels of these vessels and thus decreases the size of the bloodstream. The result is an inadequate supply of blood to those body areas provided by the thickened arteries.

Hardened arteries may rupture. If this occurs within the brain it is called *cerebral hemorrhage* or "stroke." The bleeding soon stops due to the pressure exerted by the escaped blood which clots and hardens. This may do considerable damage to brain cells. It usually occurs in the motor centers of the brain, causing one side of the body to become paralyzed. Recovery, partial if not complete, usually results. Cerebral hemorrhage, which may also be produced by the blocking of a brain artery by a blood clot, is one of the forms of apoplexy. Too much fat in the diet may initiate hardening of the blood vessels. The fat filters into the walls of the arteries causing them to become altered in a manner that brings about the formation of calcium deposits on the inside of the vessels. The calcium deposits harden the arteries and cause their channels to become narrowed.

Hypertension. Hypertension (high blood pressure) is another form of circulatory impairment. It appears to be due to increased resistance in the walls of the smallest arteries, resulting in increased blood pressure and increased work for the heart. High blood pressure is sometimes treated by a low-salt diet and a decrease in the calorie content of the diet.

CANCER

Cancer is second to diseases of the heart and blood vessels as a cause of death. It may occur in any age from infancy to old age. Nearly 2 per cent of all cancer deaths occur in persons under the age of twenty years. Although cancer is a frequent cause of death in children, most cancer victims are in middle or late life. At about thirty-five years of age

the incidence increases rapidly. The American Cancer Society estimates that one out of every eight persons now living will eventually die of cancer.

Nature of Cancer. In cancer some cells of the body multiply without restraint and grow in an uncontrolled manner, giving rise to large numbers of useless cells which develop into a large mass or tumor. Cancer thus is a disorderly, uncontrolled growth of cells in body tissues in contrast with the controlled, orderly growth of normal cells. Cancer cells crowd out or destroy normal cells and invade neighboring tissues. In some cases a few cancer cells may break away from the tumor and be carried by the lymph to other parts of the body where they may undergo an unrestricted growth. The growth may be in the interior of the body or on the surface.

Tumors that are not cancers are known as *benign tumors*, whereas those that are cancers are called *malignant tumors*. Benign tumors do not spread to other parts of the body and usually cause difficulty only by pressure and by hindering normal function in the localized area. There are two forms of cancer, *carcinoma* and *sarcoma*. Carcinoma is a malignant growth originating in epithelial tissue, as in the skin or the lining of the stomach. Sarcoma is a malignant growth from nonepithelial tissue, as connective tissue, cartilage and bone. A malignant tumor eventually breaks down and ulcerates. Cancer is associated with general ill health and progressive emaciation. Severe pain is an outstanding symptom in the later stages.

Causes of Cancer. Although its cause is unknown there are certain agents which, when acting on tissues over an extended period of time, will incite the cancerous process. It is known that chronic irritation (chemical or mechanical) of body tissues often precedes the development of cancer. Chronic irritation is considered to be a precipitating if not a fundamental cause of cancer. Agents capable of inciting a malignant growth are known as *carcinogens*. There is some evidence that long standing dietary insufficiency, especially in regard to the B group of vitamins and proteins, is an important predisposing cause of cancer of the mouth. There are two kinds of carcinogens, external and internal. Among the external agents is sunlight, but long exposure through many years is usually required since sunlight is a relatively feeble carcinogen. Other external agents are certain kinds of dust, tar, x-rays, radium and radioactive substances and numerous irritant chemicals as well as mechanical pressure or friction. The internal carcinogens are less well known. It appears that the male and female sex hormones may in some

cases belong to this category. Whether heredity plays a role in cancer is not definitely known. The tendency to develop cancer is greater apparently in some families than in others. If there is a history of cancer in the family, it is advisable that the members of the family receive periodic checkups and prompt diagnosis if any of the danger signs of cancer make their appearance. One of the newest theories as to the cause of cancer is that an unknown virus is the actual causative agent.

Certain mouth and tongue lesions (white spots) which may have existed for years may suddenly develop into cancer. Moles of long standing may suddenly develop into deeply pigmented raised growths and become cancers, especially if they are irritated. Some kinds of warts, particularly black or brown ones, may become malignant. It is only a very small percentage of moles and warts, however, that become cancerous.

Locations of Cancer. The most common locations of cancer in men are in the stomach, intestines, rectum, lips, mouth, throat, lungs, urinary bladder and prostate gland. Among women the danger zones are the uterus, breasts, intestines, rectum, stomach and urinary bladder. Leukemia, which is a fatal disease characterized by a great increase in the number of white corpuscles (leukocytes) as well as other changes in the body, is now considered to be a malignant process. It is the most common type of fatal cancer in children.

Signs Indicative of Cancer. There are certain symptoms that may or may not indicate cancer but which should be brought to the attention of a physician. Among the danger signals are: (1) a sore in the mouth, on the lips or elsewhere that does not heal within ten days to two weeks, or tends to recur in the same locality; (2) persistent hoarseness lasting more than two weeks, which is not due to a cold; (3) distress after a meal, especially in those who have not previously experienced these symptoms; (4) unexplained loss of weight; (5) any radical change in normal bowel habits; (6) the appearance of blood in the urine or stools; (7) a lump or change in symmetry of the breasts, or bloody discharges from the nipples; (8) any irregular bleeding from the uterus; (9) a lump or sore on the skin that does not heal in ten days or two weeks; and (10) a change in the color, size or character of a mole or wart, especially if located where it is subject to repeated or persistent irritation.

Treatment. It has been clearly demonstrated that cancer is frequently curable by radium, x-ray treatments or surgery, if it is recognized early and treatment instituted at once. X-ray and radium are injurious to living tissues, but destroy cancerous cells more readily than normal cells. If used in proper dosage they will kill cancerous cells with only slight

damage to normal cells. Many internal cancers, such as those of the stomach, intestine, kidney, bladder, uterus, lung or brain, are difficult to diagnose in their early stages. Pain is usually not a symptom of early cancer.

Prevention. There are ways of avoiding cancer and preventing death from cancer. The removal of all precancerous skin lesions such as moles and warts will save many lives. Avoiding sunburn, especially on the part of persons past middle age, will prevent skin cancer in some persons. Any measures taken to prevent irritation to the skin or internal organs of the body are in the direction of cancer prevention. Keeping the mouth clean and free from improperly made or fitted dental work which may chafe the tongue or cheek may prevent cancer of the mouth. Apparently, cancer of the digestive tract may in some cases be avoided by excluding foods from the dietary that have an irritating effect. It is inadvisable to swallow foods that are too hot to be held in the mouth. Choosing a well-balanced dietary and thus preventing nutritional inadequacy is probably a step in the right direction for the prevention of cancer. Some authorities believe that drinking ample quantities of water may help to prevent cancer of the bladder.

Death from cancer can often be forestalled by measures which result in early diagnosis and treatment. Many communities have established cancer control clinics for the detection of unsuspected cancer and the diagnosis of symptoms indicative of cancer. Urging people to seek medical advice as early in the course of the disease as possible is an important public health measure.

NEPHRITIS

Nephritis, or Bright's disease, is an inflammation of the kidneys which affects the membranes of the filtering units of the kidneys. It may be acute or chronic. Acute nephritis is usually the result of an infection elsewhere in the body, such as a sore throat, tonsillitis, scarlet fever or other infections caused by streptococci. The kidneys may be injured by the toxins produced by the infecting organisms even though they themselves may not become infected. Exposure to wet and cold and excessive fatigue may also bring on an attack of nephritis. The presence of blood proteins (albumin) and red blood corpuscles in the urine suggests nephritis. The symptoms may be puffiness of the face and eyelids, headache and back-ache, loss of appetite, nausea and vomiting.

In chronic nephritis degeneration of kidney cells occurs. It may be the end result of acute nephritis or may be associated with high blood

pressure and hardening of the arteries of the kidneys. When nephritis occurs, adequate medical attention can do much to minimize damage to the kidneys and relieve the symptoms. A severe case of chronic nephritis usually has a fatal outcome.

ARTHRITIS

Arthritis, commonly called rheumatism, is an inflammation of the joints of the limbs of the body. It is usually a chronic ailment and is responsible for much crippling deformity. Estimates indicate that about 7,500,000 persons in the United States are afflicted with arthritis. Of this number about 130,000 are completely disabled and 800,000 partially so. Many arthritic patients experience severe chronic or recurring pain. The cause is not definitely known but because persons who acquire arthritis frequently have chronic infected tonsils or abscessed teeth, it has been thought that the toxins of the bacteria causing these infections are the causative factors. A more recent theory attributes the disease to chronic stress and strain, emotional upsets and fatigue which bring about an imbalance in the chemistry of the body, particularly in regard to certain endocrine glands. Dampness and exposure to cold appear to be predisposing factors. The two chief types of this disease are *rheumatoid arthritis* and *osteoarthritis*. Rheumatoid arthritis usually begins before the age of forty and often causes severe crippling. Osteoarthritis usually afflicts persons beyond the age of forty. It is often associated with overweight. The crippling it causes is usually less severe than that caused by the rheumatoid type. Metabolic abnormalities associated with aging may possibly be the underlying cause. Accidental injury to a joint may be a contributing cause.

Not much is known concerning the measures necessary for the prevention of arthritis. Maintaining a high level of general health is probably an important factor. A new hormone product known as cortisone has been found to be of value in the treatment of arthritis.

DIABETES MELLITUS

Diabetes mellitus, also known as sugar diabetes, is a major chronic disease. It has been estimated that there are a million diabetics in the United States. Diabetes is a disorder due to a deficiency of insulin resulting from a disturbance in the function of the endocrine portion (islands of Langerhans) of the pancreas, or to some interference with the action of insulin in the tissues. Insulin is needed by the body for the proper utilization of sugar. The disease is manifested by an increased amount of

sugar in the blood and the presence of sugar in the urine. The most common easily recognized symptoms are extreme thirst, increased appetite, excessive urination, fatigue and progressive loss of weight. The patient may also experience muscle cramps and numbness and tingling of the feet. When the body cannot oxidize sugar it oxidizes fat in excessive amounts, resulting in the production of poisonous substances which may bring about coma and death. In the early stages of the disease the patient may not experience symptoms of any kind although the blood has a high level of sugar and sugar is present in the urine. A large number of persons have diabetes without knowing it.

Heredity is a factor in the development of diabetes. The tendency to acquire the disease, rather than the disease itself, is inherited. It is inadvisable for members of diabetic families to intermarry because such marriages may result in diabetic offspring. The majority of persons who acquire diabetes are overweight prior to the onset of the disease. An overweight person with diabetic ancestors is very likely to acquire diabetes. Obesity serves as a precipitating factor in those who are susceptible to diabetes. The majority of diabetics would never have developed the disorder if they had not permitted themselves to become overweight. The onset of diabetes is most commonly between the ages of fifty and fifty-five, but it may develop in any age. Many cases occur in childhood, adolescence and early adult life. Up to the age of thirty-five the diabetic mortality rates are the same for males and females, but after the age of forty-five more females than males die of diabetes.

Diabetics are more prone to experience serious infections than non-diabetics. Special care should be given to skin bruises and minor skin infections to keep them from developing into serious infections. Gangrene of the feet and legs is another diabetic risk to be guarded against.

A diabetic can live a normal life by combining a proper diet, regulated exercise and prescribed injections of insulin. If the presence of the disease is detected early before destructive changes in the pancreas have become pronounced, treatment may require only the restriction of the carbohydrate intake to an amount that can be properly utilized by the available body insulin. Early diagnosis in some cases may result in a cure since recent evidence indicates that early degenerative changes in the islands of Langerhans are reversible by proper dietary treatment.

To prevent diabetes it is necessary to avoid overweight. Those who have a hereditary predisposition to the disease should take extra precautions to avoid overeating. Periodic routine medical examination is advisable, especially for those who are obese.

ALLERGIC DISEASES

A condition wherein an individual displays a marked susceptibility to a substance which is harmless for the majority of human beings, is known as *allergy* or *hypersensitiveness*. Any substance which is capable of inducing allergy is called an *allergen*. Allergic reactions may be induced by the pollens of various plants, hair (human or animal), feathers, dust, various foods and many other substances. Allergy may manifest itself as hay fever, asthma, gastrointestinal upsets, migraine or skin lesions such as rashes, hives or eczema. A large share of people are allergic in varying degrees to one or more substances. Multiple sensitivities are quite common. Persons allergic to many substances are at a considerable disadvantage in maintaining a state of health. The tendency to become allergic apparently is inherited.

The precise nature of the allergic reaction is not entirely clear. It is considered to be a reaction between the allergen and certain chemical substances produced by the body which belong to the category of antibodies. The reaction occurs in certain tissues and involves the liberation from the tissues of histamine or a histamine-like chemical, which produces the allergic reaction. Histamine is normally present in small amounts in all the tissues of the body.

Hay Fever and Asthma. Most cases of hay fever and asthma are caused by the inhalation of pollen. Many plants are dependent upon wind-borne pollen for the process of pollination. Since the pollen grains of these plants are very light they readily enter the air, often in enormous quantities, and may be carried long distances by air currents. Hay fever is characterized by inflammation of the upper respiratory tract and the eyes. The spring type of hay fever is due to tree pollens, the summer type to the pollens of grasses and the fall type in most cases to ragweed pollen. Asthma is characterized by recurrent attacks of difficult or labored breathing, due to spasmodic contraction of the bronchial tubes. Many other allergens, particularly dust, feathers and certain foods, may give rise to asthma.

Food Allergy. Hypersensitivity to food is quite common. A person may be allergic to a single food or to several kinds of food which others may eat with impunity. Symptoms such as abdominal pain, vomiting or diarrhea may follow shortly after partaking of the food or there may be skin lesions in the form of red areas (wheals) which itch persistently. A skin disorder of this type is commonly called "hives." In some individuals food allergy gives rise to asthma.

Other Types of Allergy. Many cases of eczema are due to hypersensitivity. The allergen may be food but often it is a substance that comes in mechanical contact with the skin (contact allergen). Certain drugs may give rise to allergy, often in the form of skin reactions such as a rash and itching. Drugs frequently concerned are aspirin, bromides, arsphenamine, cinchona and iodides. The dermatitis caused by poison ivy, poison oak and poison sumac is an allergic reaction.

Diagnosis. In many cases of allergy the skin is sensitive to the allergen. This is made use of in determining the allergen responsible for a given case of allergy. An extract of the suspected allergen is applied to a superficial scratch in the skin or injected into the skin. A positive reaction consists in the formation within a few minutes of a red raised area at the point of application.

Prevention and Treatment. A patient can be cured of allergy by avoiding the specific exciting agent responsible for his symptoms. In some cases he can be desensitized by a series of hypodermic injections of the allergen. By gradually increasing the amount of allergen injected the body develops a tolerance for it. In some cases the desensitization is partial rather than complete. It appears that in the process of desensitization the body is stimulated to produce so-called antibodies which are capable of neutralizing the allergen before it reaches the sensitized cells.

Certain chemical compounds such as benadryl and pyribenzamine are sometimes used in the treatment of allergy. These anti-allergy drugs apparently have a neutralizing effect on histamine and give palliative relief to many allergic individuals. The relief they provide, however, is not always complete. The drugs must be used with care since they may produce extreme drowsiness, depression, confusion, headache and attacks of diarrhea.

QUESTIONS FOR CLASS DISCUSSION

1. Has as much progress been made in the control of chronic degenerative diseases as in the control of infections?
2. Give examples of chronic degenerative diseases.
3. Name some of the factors that may give rise to these diseases.
4. Discuss rheumatic fever and rheumatic heart disease.
5. What is coronary heart disease?
6. Name the chief degenerative diseases of the blood vessels.
7. Discuss cancer in regard to (1) its general nature, (2) inciting factors, (3) parts of the body it may attack, (4) indicative signs, (5) treatment, (6) prevention.
8. What is nephritis?
9. Discuss arthritis in regard to (1) prevalence, (2) damaging effects, (3) possible predisposing factors.

10. Is heredity a factor in the development of diabetes?
11. How can diabetes usually be prevented?
12. Name some common allergic diseases. How can they be prevented?

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